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**CONTRACT NO. N62473-10-D-0809
CTO No. 0004**

FINAL

**SURVEY UNIT PROJECT REPORTS ABSTRACT FOR
SANITARY SEWER AND STORM DRAIN REMOVAL
CONDUCTED AFTER JANUARY 1, 2011**

July 8, 2011

DCN: RMAC-0809-0004-0005

**HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA**



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Dear Regulatory Team Members:

Enclosed please find the Final Survey Units Project Reports Abstract for Sanitary Sewer and Storm Drain Removal Conducted After January 2011, Hunters Point Shipyard, San Francisco, California. This document incorporates all changes in sample analysis, data quality assurance, and data reporting associated with the new laboratory procedures that were implemented in 2011. This document is being submitted for your records only.

If you have any questions regarding the enclosed document, please contact Mr. Chris Yantos at (619) 532-0912, or Mr. Keith Forman at (619) 532-0913 at your earliest convenience.

Sincerely,

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. Final, Survey Units Project Reports Abstract for Sanitary Sewer and Storm Drain Removal Conducted After January 2011, Hunters Point Shipyard, San Francisco, California, July 2011.

JUL 8 2011

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TABLE OF CONTENTS

	<u>PAGE</u>
ABBREVIATIONS AND ACRONYMS	iii
1.0 INTRODUCTION	1-1
1.1 PURPOSE	1-1
1.2 BACKGROUND	1-1
2.0 RELEASE CRITERIA	2-1
2.1 RELEASE LIMITS	2-1
2.2 AS LOW AS REASONABLY ACHIEVABLE	2-1
2.3 ENVIRONMENTAL ALARA PROCESS	2-2
2.3.1 Identification of Potential Radiological Impacts	2-2
2.3.2 Review of Radiological Impacts	2-2
2.3.3 Performance of Qualitative ALARA Analyses	2-3
2.3.4 Performance of Quantitative ALARA Analyses	2-3
2.4 RADIONUCLIDES OF CONCERN	2-4
2.5 RELEASE CRITERIA FOR RADIONUCLIDES OF CONCERN	2-5
2.6 INVESTIGATION LEVEL FOR GAMMA SCAN SURVEYS	2-5
3.0 FINAL STATUS SURVEYS	3-1
3.1 OBJECTIVE OF THE FINAL STATUS SURVEYS	3-1
3.2 SURVEY UNITS	3-1
3.2.1 Trench Survey Units	3-1
3.2.2 Excavated Soil Survey Units	3-2
3.2.3 Soil Scanning at the Radiological Screening Yard	3-2
3.2.4 Import Fill	3-9
3.3 REFERENCE AREA	3-10
4.0 LABORATORY ANALYSIS	4-1
4.1 SAMPLE PREPARATION	4-1
4.2 GAMMA SPECTROSCOPY ANALYSIS	4-2
4.3 GAMMA SPECTROSCOPY ANALYSIS FLAGS	4-2
4.4 TOTAL STRONTIUM/STRONTIUM-90 ANALYSIS	4-3
4.5 COUNTING UNCERTAINTY	4-3
4.6 DATA ASSESSMENT	4-4
4.6.1 Data Verification	4-4
4.6.2 Data Validation	4-4
4.6.3 Data Evaluation	4-4
4.6.4 Data Quality Assessment	4-5
5.0 STATISTICAL TESTS	5-1
5.1 DECISION ERRORS	5-1
5.2 WILCOXON RANK-SUM TEST	5-1

TABLE OF CONTENTS

(Continued)

	<u>PAGE</u>
5.2.1 Determining the Numbers of Data Points for the WRS Test.....	5-2
5.2.2 Determining Data Points for Small Areas of Elevated Activity	5-3
6.0 DOSE MODELING.....	6-1
7.0 RECOMMENDATION OF FINAL UNRESTRICTED RELEASE.....	7-1
8.0 REFERENCES	8-1

TABLES

Table 2-1 Radionuclides of Concern.....	2-4
Table 2-2 Release Criteria.....	2-5
Table 3-1 Class 1 Soil Measurements – Import Fill Material – Mills Peninsula.....	3-11
Table 3-2 Class 1 Soil Measurements – Import Fill Material – Jericho	3-12
Table 3-3 Class 1 Soil Measurements – Background Reference Area	3-13

FIGURES

Figure 3-1 RSY-2 Excavated Soil Unit Sampling Diagram.....	3-3
Figure 3-2 RSY-3 Excavated Soil Unit Sampling Diagram.....	3-5
Figure 3-3 RSY-4 Excavated Soil Unit Sampling Diagram.....	3-7

ATTACHMENTS

Attachment 1 Import Fill Material Sample Results	
Attachment 2 Reference Area Sample Results	

ABBREVIATIONS AND ACRONYMS

$\mu\text{R/h}$	microroentgens per hour
ALARA	as low as reasonably achievable
AM	Action Memorandum
^{214}Bi	bismuth-214
COC	chain of custody
cps	counts per second
^{137}Cs	cesium-137
DoD	Department of Defense
DON	Department of the Navy
DQA	data quality assessment
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ESU	excavated soil unit
FSS	Final Status Survey
GPS	global positioning system
HPNS	Hunters Point Naval Shipyard
HRA	Historical Radiological Assessment
keV	kiloelectron volt
LBGR	lower boundary of the gray region
LMI	Ludlum Measurements, Inc.
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDL	method detection limit
NRC	Nuclear Regulatory Commission
pCi/g	picocuries per gram
QA	quality assurance
QC	quality control
^{226}Ra	radium-226
RASO	Radiological Affairs Support Office
ROC	radionuclide of concern
RSY	Radiological Screening Yard

ABBREVIATIONS AND ACRONYMS

(Continued)

RTK	real-time kinematic
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
^{90}Sr	strontium-90
SUPR	Survey Unit Project Report
VSP	Visual Sample Plan
WRS	Wilcoxon Rank-Sum

1.0 INTRODUCTION

1.1 PURPOSE

This Survey Unit Project Reports (SUPRs) Abstract summarizes the scope, approach, and radiological surveys used during removal of the sanitary sewers and storm drains located within Hunters Point Naval Shipyard (HPNS) conducted after January 1, 2011. This Abstract will be applicable to all associated SUPRs and data sets prepared for regulatory review unless otherwise noted.

This Abstract was prepared under Contract No. N62473-10-D-0809, Contract Task Order No. 0004.

1.2 BACKGROUND

Based on the site's operational history described in the final Historical Radiological Assessment (HRA), Volume II (NAVSEA 2004) and site-specific investigative data, the Department of the Navy (DON) determined that the HPNS sanitary sewer and storm drain systems contain radioactive contamination in soils and debris requiring a response action. This decision is documented in the final Base-wide Radiological Removal Action, Action Memorandum (AM) – Revision 2006 (DON 2006), which was created to implement the recommendations of the HRA.

HPNS is a site where radioactive materials have been used or stored, where known spills, discharges, or other instances involving radioactive materials have occurred, and where radioactive materials might have been disposed of or buried. The sanitary sewer and storm drain systems have a potential for general radioactive material contamination based on the site operating history or known contamination detected during previous radiation surveys.

The DON initiated this removal action for the extraction of piping systems and soil containing radioactive contaminants that may be present in or around the sanitary sewer and storm drain systems. This removal action will serve to eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the site to the surrounding environment. Currently, such a release could occur as a result of wastewater or stormwater transport, erosion, weathering, seismic events, or biological activity.

The HRA (NAVSEA 2004) states that the present-day configuration of the sanitary sewer and storm drain systems is the result of an evolutionary process. This system was originally designed and built in the 1940s as a combined system, using the same conveyance piping and 40 separate discharge outfalls into San Francisco Bay.

This combined system grew in sections from the 1940s to its maximum size in 1958, when it underwent the first in a series of separation projects. The Building 819 pump station was constructed for conveyance of much of the sanitary sewage from HPNS to the City of San Francisco treatment works, and separation of the systems took place in the industrial areas and the southwest area of HPNS. Separation of the systems involved installation of dedicated sanitary sewer collection piping or diversion structures within the combined system piping that normally directed all combined flows through the Building 819 pump station. However, during storm events, stormwater flows would overwhelm Building 819, and much of the sewage and stormwater was diverted to various existing outfalls into the bay. Twenty-eight bay outfalls were converted to exclusive use for stormwater outlets, while 12 continued to serve as combined sanitary and stormwater sewer outlets.

A second segregation project, undertaken in 1973, provided some additional separation of the combined systems. The last of the separation projects performed in 1976 involved the installation of additional dedicated sanitary sewer piping. Complete separation of the combined systems was never achieved. Due to the evolutionary nature of the separation process, radiological contamination from the same source could have impacted the piping and other components of both systems.

2.0 RELEASE CRITERIA

2.1 RELEASE LIMITS

The DON is taking steps to ensure that residual radioactivity at an area will not result in individuals being exposed to unacceptable levels of radiation or radioactive materials. Regulatory agencies establish radiation dose standards based on risk considerations and scientific data relating dose to risk. Residual levels of radioactive material that correspond to allowable radiation dose standards are derived by analysis of various pathways and scenarios such as direct exposure, inhalation, and ingestion.

These levels, known as release limits, are presented in terms of soil activity concentration. Release limits usually refer to average levels of radiation or radioactivity above appropriate background levels. Release limits applicable to soil are expressed in units of activity concentration, picocuries per gram (pCi/g). The development of release limits is often an iterative process, where the release limits selected or developed are modified as additional site-specific information is obtained. The development of final cleanup levels was based on the Nuclear Regulatory Commission's (NRC's) screening levels, the U.S. Environmental Protection Agency's (EPA's) preliminary remediation goals, or agreements between the DON and regulatory agencies as documented in the AM.

2.2 AS LOW AS REASONABLY ACHIEVABLE

As low as reasonably achievable (ALARA) is a philosophy of striving for excellence in the practice of health physics and is an important aspect of radiation-safety regulations. The National Council on Radiation Protection and Measurements has stated, "ALARA is simply the continuation of good radiation-protection programs and practices which traditionally have been effective in keeping the average and individual exposures for monitored workers well below the limits" (NCRP 1993). The application of ALARA clearly includes the consideration of economic and social factors, and thus will inherently be different for different sources or facilities.

The ALARA concept is founded in the professional judgment of radiation-safety managers and personnel and is not, therefore, able to be used as a measure as to whether or not a particular radiation-safety program is adequate in comparison with other programs. Additionally, the ALARA concept does not provide a numerical limit below which the ALARA concept is achieved.

2.3 ENVIRONMENTAL ALARA PROCESS

This section describes the steps taken to implement the environmental ALARA policy:

1. Identification of Potential Radiological Impacts
2. Review of Radiological Impacts
3. Performance of Qualitative ALARA Analyses
4. Performance of Quantitative ALARA Analyses

2.3.1 Identification of Potential Radiological Impacts

Each new radiological operation is subjected to ALARA reviews before work begins to ensure that radiation exposures to workers, the public, and the environment meet ALARA principles. ALARA reviews are conducted for all operations, practices, and procedures that have potential for individual or collective doses to workers. Reviews culminate in changes or additions to work planning documents, standard operating procedures (SOPs), and radiological work permits.

These documents are used to identify activities that have potential for radiological environmental impacts and could require environmental ALARA analysis. If a radiological impact is identified that could impact the environment significantly, the Radiation Safety Officer communicates the impact to the work staff and the Radiological Affairs Support Office (RASO).

2.3.2 Review of Radiological Impacts

Radiological impacts to the environment, workers, and the public from field operations are assessed for compliance with ALARA principles. Results from radiological survey activities, and air, soil, sediment, and water samples are used to assess the radiological impacts of HPNS activities.

Determination of environmental radiological impacts from radiological activities is performed using nine methods: 1) air monitoring stations located around the excavation site perimeter to track radiological impacts; 2) field monitoring and sampling to identify areas requiring additional remediation; 3) remediation of contaminated areas at or above the release criteria; 4) control of radiologically impacted areas and work sites; 5) frisking of personnel and examining equipment leaving a radiologically controlled area; 6) use of release criteria that equate to dose and risk; 7) review of historical radiological operations to allow complete investigation of all areas of radiological concern; 8) complete characterization of radiologically impacted sites to ensure complete removal of radioactive material above the release criteria; and 9) dosimetry worn by personnel to measure time-averaged doses from gamma radiation.

2.3.3 Performance of Qualitative ALARA Analyses

Laboratory analyses are performed for 19 different isotopes to ensure that any possible radioactive contamination is identified. After each excavation is completed, the qualitative radiological impacts from operations are evaluated by performing a dose and risk assessment. The results of analysis and assessments are provided to the RASO and regulatory agencies for review.

2.3.4 Performance of Quantitative ALARA Analyses

Based on qualitative ALARA analyses, excavation projects that could cause a potential dose to the public are subjected to quantitative ALARA analyses using the steps described below.

Quantitative ALARA analyses include societal, technological, economic, and public policy considerations. In addition, these ALARA analyses consider NRC guidance for performing the following environmental ALARA assessments:

- Identification of possible radiation protection systems, such as alternative operating methods or controls, that are reasonably achievable. The options should range from the most rudimentary (base case) to the most technologically sophisticated systems.
- Quantification of exposures and doses to workers and the public in the vicinity of the work through air monitoring and dosimetry.
- Quantification of the economic factors, including the costs of purchasing, installing, operating, and maintaining the radiological equipment, and the potential health effects associated with the exposure of people and any other direct or indirect cost resulting from exposures to radiation during investigations and/or remediations.
- Identification and estimation of other health and non-health detriments and benefits, such as equipment loss and accidents.
- Evaluation of process alternatives using a quantitative cost-benefit analysis, when possible. When evaluations included assumptions, judgments, and limitations that could be quantified, and potential doses were well below the dose limit, qualitative analyses were used with full documentation.
- Implementation of the ALARA principles and monitoring of the results.

The following specific factors are used in performing a quantitative ALARA analysis:

- Dose to workers, the public, and the environment before and during work processes
- Residual dose to the local population
- Applicable alternative processes (treatments, operating methods, or controls) for site investigations or remediations

- Costs for each alternative evaluated
- Societal and environmental (positive and negative) impacts associated with alternatives

Based on recent estimates of dose to the public from HPNS operations, only qualitative ALARA analyses were required. Much of the data and analysis used for environmental ALARA evaluations is developed as part of the routine work processes.

To ensure that ALARA levels are met, removal actions conducted in accordance with the AM are designed to 1) substantially reduce ionizing radiation below cleanup goals and 2) eliminate identified pathways of exposure to ionizing radiation.

2.4 RADIONUCLIDES OF CONCERN

As listed in Table 3-1 of the Work Plan (TtEC 2010), the primary radionuclides of concern (ROCs) for most survey units were cesium-137 (^{137}Cs), radium-226 (^{226}Ra), and strontium-90 (^{90}Sr). Table 2-1 lists those ROCs. The principal types of radiation (alpha, beta, and gamma) and associated half-lives are also identified for measurement purposes.

TABLE 2-1
RADIONUCLIDES OF CONCERN

Radionuclide	Half-life	Radiations
Cesium-137	30.17 years	Beta/gamma (β^- , γ)
Radium-226	1,600 years	Alpha (α)/gamma (γ)
Strontium-90	28.6 years	Beta (β^-)

Exceptions to the ROCs will be individually noted in the specific SUPR, as necessary. One hundred percent of the samples collected were analyzed by gamma spectroscopy at a Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) accredited laboratory, TestAmerica St. Louis, for definitive data. Ten percent of the samples were also analyzed for ^{90}Sr .

The presence of ^{90}Sr would primarily be attributed to fission products associated with OPERATIONS CROSSROADS and decontamination of ships that participated in atomic weapons testing. Since ^{137}Cs would have also been present, any sample containing activity greater than the release criteria for ^{137}Cs was also analyzed for ^{90}Sr .

2.5 RELEASE CRITERIA FOR RADIONUCLIDES OF CONCERN

Radionuclide-specific release criteria were obtained for each ROC using the criteria established by the NRC and EPA, as discussed in Section 2.1. The release criteria are shown in Table 2-2. Survey units for the sanitary sewer and storm drain removal project are considered acceptable when the radionuclide concentrations meet the soil release criteria defined in Table 2-2.

TABLE 2-2
RELEASE CRITERIA

Radionuclide	Soil			
	Outdoor Worker (pCi/g)	Residual Dose (mrem/y) ^a	Residential (pCi/g)	Residual Dose (mrem/y) ^a
Cesium-137	0.113	0.2142	0.113	0.2561
Radium-226	1.0 ^b	6.342	1.0 ^b	14.59
Strontium-90	10.8	0.1931	0.331	1.648

Notes:

^a The resulting dose is based on modeling using RESRAD Version 6.3, with radon pathways turned off.

^b Limit is 1 pCi/g above background, per agreement with EPA.

Abbreviations and Acronyms:

EPA – U.S. Environmental Protection Agency

mrem/y – millirems per year

pCi/g – picocuries per gram

2.6 INVESTIGATION LEVEL FOR GAMMA SCAN SURVEYS

Investigation levels are specific levels of radioactivity used to indicate when additional investigation may be necessary. Investigation levels also serve as a quality control (QC) check. For example, in addition to indicating potential contamination, a measurement that exceeds the investigation level may have indicated a failing instrument.

When determining an investigation level using a statistical based parameter (for example, standard deviation), the following may be considered: survey objectives, underlying radionuclide distributions (normal, log-normal, nonparametric), data population descriptors (standard deviation, mean, median), and prior survey and historical information.

When an investigation level was exceeded, the measurement would have been confirmed to ensure that the initial measurement actually exceeds a particular investigation level. This involved taking further measurements to confirm the initial result and, as appropriate, to quantify the area of elevated residual radioactivity.

The investigation level for gamma surveys was established as the reference area mean + 3 σ where σ is the standard deviation of the gamma readings in the reference area.

3.0 FINAL STATUS SURVEYS

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NUREG-1575; DoD et al. 2000), the Nonparametric Statistical Methodology for the Design and Analysis of the Final Status Decommissioning Survey Guide (NUREG-1505; NRC 1998), and the Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions Guide (NUREG-1507; NRC 1997) were used as guidance in designing and conducting the Final Status Surveys (FSSs).

3.1 OBJECTIVE OF THE FINAL STATUS SURVEYS

The objective of the FSS was to demonstrate that identified residual radioactivity levels inside the excavated trench and subsequent overburden soils to be used as backfill met the release criteria. In demonstrating that this objective was met, the null hypothesis (H_0) was tested for residual contamination that exceeds the release criteria. The alternative hypothesis (H_a) was stated as residual contamination that meets the release criteria.

3.2 SURVEY UNITS

Sanitary sewer and storm drain systems were divided into manageable work areas, as designated in the specific design and work plans that are submitted for regulatory review. Smaller survey units were identified within each work area. There were two types of survey units: trench and excavated soil. Trench survey units are survey units constructed by the surface area remaining as sanitary sewer and storm drain lines, as well as surrounding soil, are removed. Excavated soil survey units are created from the soil excavated during sanitary sewer and storm drain removal, so that the soil can be surveyed to determine its acceptability for use as fill material. Although the size of each survey unit may vary, each received the same scan survey and systematic sampling frequency.

3.2.1 Trench Survey Units

Scan surveys and systematic sampling were performed for each identified survey unit. Trench survey units varied in size but did not exceed 1,000 square meters in surface area. Systematically located postexcavation samples were collected after establishing a grid using Visual Sample Plan (VSP). Additional surveys may have been performed if the investigation levels were exceeded.

Accessible surface areas of each trench unit were scanned using Ludlum Model 44-10 2-inch by 2-inch sodium iodide scintillation detectors coupled to Ludlum Model 2350-1 data loggers. The scan surveys were performed at a rate of approximately 0.08 meter per second with the detector held approximately 10 centimeters (4 inches) above the trench sidewalls and floor as appropriate.

The detector was moved back and forth across the travel path while scanning, producing a serpentine scan pattern. Areas of elevated activity identified during the scan survey were investigated further. Trench unit scan survey data are provided as an attachment to each individual SUPR.

Each trench unit was mapped using computer-aided design technologies. First, the trench centerline was plotted, and then the extent of the trench excavation was drawn, with walls splayed out flat, into a two-dimensional plane. The design was then extracted into VSP to determine the locations of systematic sample points.

A minimum of 18 systematic sample locations, based on a random start point and the triangular grid pattern, were generated using VSP and are provided in each SUPR. Sample collection points were placed in the field using approved land surveying technologies and identified with the global positioning system (GPS).

3.2.2 Excavated Soil Survey Units

During the course of excavation from Parcels C, D-1, D-2, E, E-2, and Utility Corridor sanitary sewer and storm drain lines, the soils from these excavations were removed to dewatering/screening pads located in the Radiological Screening Yards (RSYs). The soils were then spread out in lifts not to exceed 6 inches in thickness and 1,000 square meters in total surface area. Each of these areas was then assigned an incremental number and identified as an excavated soil unit (ESU).

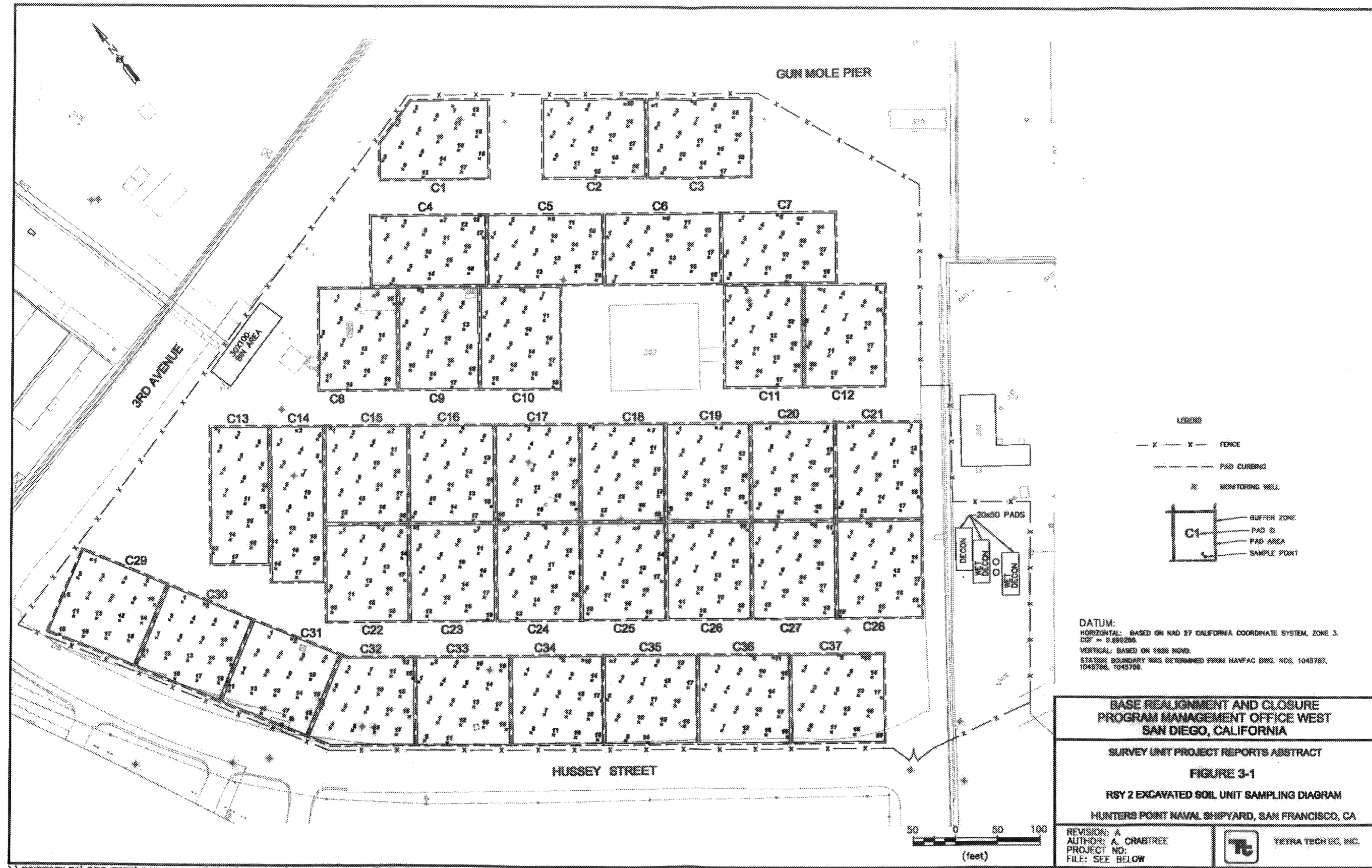
The gamma scan data for each ESU are presented as an attachment to each SUPR, as applicable.

The entire area of each ESU was plotted in VSP, and 18 systematic sampling locations were determined using a random start point on a triangular grid pattern. Typical systematic sampling locations used for each ESU are shown on Figures 3-1, 3-2, and 3-3. The final sampling locations of ESUs are provided in each SUPR, as applicable.

3.2.3 Soil Scanning at the Radiological Screening Yard

Each ESU was scanned using a towed array system. For the sanitary sewer and storm drain systems surveyed under this SUPRs Abstract, two systems were used.

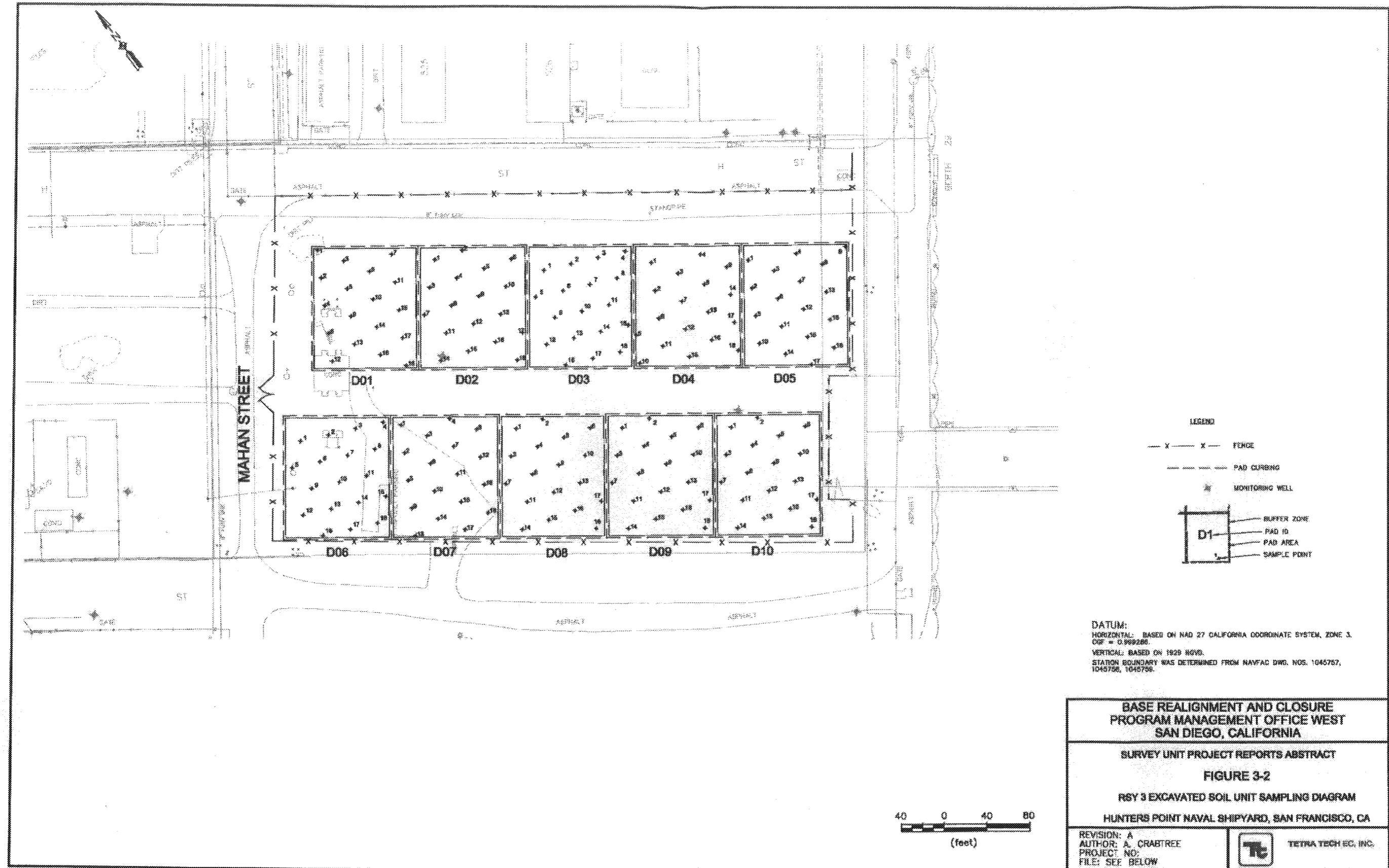
FIGURE 3-1
RSY-2 EXCAVATED SOIL UNIT SAMPLING DIAGRAM



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FIGURE 3-2
RSY-3 EXCAVATED SOIL UNIT SAMPLING DIAGRAM



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FIGURE 3-3
RSY-4 EXCAVATED SOIL UNIT SAMPLING DIAGRAM



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The first system is the Drive Over Array M251. The M251 system is constructed with a 40- by 6- by 2-inch gamma scintillation detector provided by Ludlum Measurements, Inc. (LMI), coupled to an LMI Model 2350-1 Data Logger, with positioning provided by a Trimble® ProXT GPS. The system integrates both GPS and counts from the detector using Trimble's TerraSync system (via Bluetooth® technology). The M251 is designed to measure both gamma radiation and GPS accurately.

GPS was selected based on its ability to reliably measure position within 1 meter (and typically within 30 centimeters). The detector was chosen to provide a wide angle of scan in a rugged and reliable package. Scan speeds of the system are limited to an average of 0.3 meter per second with a detector height of 10 centimeters, which are consistent with the detector height presented in NUREG-1507, and are slow enough to provide adequate data acquisition over each pad. The system was constructed on a portable trailer, coupled to a 20-horsepower John Deere tractor.

The second system is a Vehicle Towed Array system in support of radiological clearance of remediated soil over areas with relatively flat terrain and/or radiological screening pads. The system is constructed with two 12- x 39- x 1.5-inch (30.5- x 99- x 3.8-centimeter) DA372 organic plastic scintillators manufactured by TSA, coupled to a TSA Model SC-770 data controller, with positioning provided by three dual-frequency, high-resolution Leica GPSs with real-time kinematic (RTK) positioning capabilities that provide fixed solution accuracy (1 to 5 centimeters). One GPS is for the detector positioning, one GPS is for the swath guidance system, and one GPS is for the RTK base station. The system integrates both GPS and counts from the detector. The SC-770 is designed to provide a mobile platform capable of measuring both gamma radiation and GPS very accurately.

The GPS system was selected based on the ability to reliably measure position within 5 centimeters of the center of the detector. This GPS system has been used extensively for unexploded ordnance work for Tetra Tech EC, Inc. Scan speeds of the system are limited to an average of 0.5 meter per second or 1.8 kilometers per hour with a detector height of 4 inches, which is consistent with the detector height presented in NUREG-1507 and is slow enough to provide adequate data acquisition over each surface area.

3.2.4 Import Fill

In February 2007, a local source of import fill material was found in the Burlingame, California, area from the expansion of the Mills Hospital facility. This soil was screened both chemically and radiologically before being delivered for use as residential fill material at HPNS. This import fill material met the standards specified in Table B.7-1 of the Sampling and Analysis Plan (SAP) (TtEC 2008) and Worksheet #17 of the current SAP (TtEC 2011). Approximately 100,000 cubic yards of the material was stockpiled at HPNS.

In 2011, import fill material was purchased from Jericho. This soil was screened both chemically and radiologically before being delivered for use as residential fill material at HPNS. This import fill material met the standards specified in Worksheet #29 of the SAP (TtEC 2011), and approximately 40,000 cubic yards of the material was stockpiled at HPNS.

Eighteen random soil samples were collected from the Mills Hospital import fill stockpile, and 20 random soil samples were collected from the Jericho import fill stockpile. The samples were analyzed by gamma spectroscopy. The results of the random soil samples are used when performing dose modeling when import fill material was used to backfill a trench.

The import fill material gamma spectroscopy and ^{90}Sr results are provided in Attachment 1. Table 3-1 provides a summary of the results of the import fill material from the Mills Hospital facility. Table 3-2 provides a summary of the results of the import fill material from Jericho.

3.3 REFERENCE AREA

Reference area samples for the sanitary sewer and storm drain removal project were obtained in April 2006 in an area of the Building 813 parking lot in Parcel D-2. Building 813 was identified in the HRA as being impacted, but the parking lot area was not identified as being impacted and is considered of like material to that encountered in the soils in survey units. Eighteen samples were collected systematically from this area for reference area purposes. All 18 samples were analyzed at the on-site screening laboratory by gamma spectroscopy for use in time-critical radiological remediation decisions. Ten percent of the samples (two samples total) were also analyzed for ^{90}Sr at the on-site laboratory. The reference area samples provided a basis for net activity concentration. Background activity for ^{226}Ra was determined to be 0.485 pCi/g, placing the on-site laboratory remediation decision level at 1.485 pCi/g of ^{226}Ra for radiological remediation decisions only. The gamma spectroscopy samples and ^{90}Sr samples were also sent to a DoD ELAP accredited off-site laboratory (TestAmerica St. Louis) for analysis and use as reference area definitive data used in each SUPR. Background activity for ^{226}Ra , based on the mean of the greater of the reported activity or method detection limit (MDL), was determined to be 0.625 pCi/g, placing the release criterion at 1.625 pCi/g of ^{226}Ra for final definitive data. Note that this value is used in each SUPR for background subtraction of ^{226}Ra for dose and risk modeling.

The reference area gamma spectroscopy and ^{90}Sr results from the DoD ELAP accredited off-site laboratory (TestAmerica St. Louis) are provided in Attachment 2. A summary of the results is provided in Table 3-3.

TABLE 3-1

Class 1 Soil Measurements - Import Fill Material - Mills Peninsula

Sample No.	Date	Time	¹³⁷ Cs	Flag	MDL	Results (pCi/g)		Flag	MDL	>MDL
						>MDL	²²⁶ Ra			
1	2/19/2007	7:30:00	-0.002	U	0.029	0.029	0.533	J	0.075	0.533
2	2/19/2007	7:40:00	0.006	U	0.036	0.036	0.569	J	0.050	0.569
3	2/19/2007	7:50:00	0.026	U	0.036	0.036	0.761		0.072	0.761
4	2/19/2007	8:00:00	0.011	U	0.036	0.036	0.605	J	0.062	0.605
5	2/19/2007	8:10:00	0.000	U	0.059	0.059	0.648	J	0.067	0.648
6	2/19/2007	8:20:00	0.020	U	0.048	0.048	0.705		0.072	0.705
7	2/19/2007	8:30:00	0.001	U	0.044	0.044	0.573	J	0.043	0.573
8	2/19/2007	8:40:00	0.016	U	0.033	0.033	0.438	J	0.083	0.438
9	2/19/2007	8:50:00	0.020	U	0.037	0.037	0.489	J	0.067	0.489
10	2/19/2007	9:00:00	-0.018	U	0.035	0.035	0.330	J	0.064	0.330
11	2/19/2007	9:10:00	0.001	U	0.040	0.040	0.520	J	0.044	0.520
12	2/19/2007	9:20:00	0.001	U	0.029	0.029	0.512	J	0.039	0.512
13	2/19/2007	9:30:00	0.015	U	0.033	0.033	0.427	J	0.047	0.427
14	2/19/2007	9:40:00	-0.005	U	0.030	0.030	0.438	J	0.050	0.438
15	2/19/2007	9:50:00	-0.003	U	0.063	0.063	0.429	J	0.073	0.429
16	2/19/2007	10:00:00	-0.018	U	0.050	0.050	0.405	J	0.080	0.405
17	2/19/2007	10:10:00	0.000	U	0.044	0.044	0.682	J	0.062	0.682
18	2/19/2007	10:20:00	0.004	U	0.038	0.038	0.616	J	0.060	0.616
mean						0.040				0.538
std dev						0.010				0.117
median						0.037				0.527

Notes:

Information concerning flags associated with the on-site laboratory data can be found in Section 4.3.

Abbreviations and Acronyms:

¹³⁷Cs – cesium-137

MDL – method detection limit

pCi/g – picocuries per gram

²²⁶Ra – radium-226

std dev – standard deviation

TABLE 3-2

Class 1 Soil Measurements - Import Fill Material - Jericho

Sample No.	Date	Time	¹³⁷ Cs	Flag	MDL	Results (pCi/g)				
						≥MDL	²²⁶ Ra	Flag	MDL	≥MDL
1	5/13/2011	10:05:00	0.012	U	0.032	0.032	0.369	J	0.046	0.369
2	5/13/2011	10:10:00	0.018	U	0.054	0.054	0.297	J	0.067	0.297
3	5/13/2011	10:15:00	0.012	U	0.026	0.026	0.319	J	0.049	0.319
4	5/13/2011	10:20:00	-0.008	U	0.032	0.032	0.295	J	0.061	0.295
5	5/13/2011	10:25:00	0.000	U	0.028	0.028	0.376	J	0.052	0.376
6	5/13/2011	10:30:00	-0.005	U	0.041	0.041	0.392	J	0.071	0.392
7	5/13/2011	10:35:00	-0.003	U	0.042	0.042	0.318	J	0.063	0.318
8	5/13/2011	10:40:00	-0.030	U	0.062	0.062	0.554	J	0.051	0.554
9	5/13/2011	10:45:00	0.026	U	0.046	0.046	0.473	J	0.082	0.473
10	5/13/2011	10:50:00	0.005	U	0.022	0.022	0.406	J	0.051	0.406
11	5/13/2011	10:55:00	-0.005	U	0.037	0.037	0.409	J	0.046	0.409
12	5/13/2011	11:00:00	0.005	U	0.033	0.033	0.461	J	0.049	0.461
13	5/13/2011	11:05:00	-0.001	U	0.042	0.042	0.279	J	0.082	0.279
14	5/13/2011	11:10:00	0.034	U	0.040	0.040	0.332	J	0.064	0.332
15	5/13/2011	11:15:00	0.003	U	0.062	0.062	0.290	J	0.066	0.290
16	5/13/2011	11:20:00	0.017	U	0.046	0.046	0.605	J	0.022	0.605
17	5/13/2011	11:25:00	-0.005	U	0.034	0.034	0.462	J	0.061	0.462
18	5/13/2011	11:30:00	0.011	U	0.035	0.035	0.347	J	0.079	0.347
19	5/13/2011	11:35:00	-0.004	U	0.035	0.035	0.453	J	0.037	0.453
20	5/13/2011	11:40:00	-0.003	U	0.047	0.047	0.486	J	0.072	0.486
mean						0.040				0.396
std dev						0.011				0.092
median						0.039				0.384

Notes:

Information concerning flags associated with the on-site laboratory data can be found in Section 4.3.

Abbreviations and Acronyms:

¹³⁷Cs – cesium-137

MDL – method detection limit

pCi/g – picocuries per gram

²²⁶Ra – radium-226

std dev – standard deviation

TABLE 3-3

Class 1 Soil Measurements - Background Reference Area

Sample No.	Date	Time	¹³⁷ Cs	Flag	MDL	≥MDL	Results (pCi/g)							
							⁹⁰ Sr	Flag	MDL	≥MDL	²²⁶ Ra	Flag	MDL	≥MDL
1	4/26/2006	12:00:00	0.021	U	0.025	0.025					0.827		0.040	0.827
2	4/26/2006	12:00:00	-0.012	U	0.054	0.054					0.666	J	0.042	0.666
3	4/26/2006	12:00:00	0.000	U	0.028	0.028					0.786		0.052	0.786
4	4/26/2006	12:00:00	0.002	U	0.034	0.034					0.548	J	0.050	0.548
5	4/26/2006	12:00:00	0.005	U	0.038	0.038	-0.204		0.194	0.194	0.878		0.061	0.878
6	4/26/2006	12:00:00	0.013	U	0.033	0.033	-0.123		0.194	0.194	0.447	J	0.072	0.447
7	4/26/2006	12:00:00	0.020	U	0.035	0.035					0.459	J	0.048	0.459
8	4/26/2006	12:00:00	-0.007	U	0.037	0.037					0.626	J	0.059	0.626
9	4/26/2006	12:00:00	-0.028	U	0.050	0.050					0.510	J	0.066	0.510
10	4/26/2006	12:00:00	0.012	U	0.036	0.036					0.839		0.030	0.839
11	4/26/2006	12:00:00	0.001	U	0.036	0.036					0.728		0.052	0.728
12	4/26/2006	12:00:00	-0.013	U	0.042	0.042					0.546	J	0.060	0.546
13	4/26/2006	12:00:00	0.000	U	0.033	0.033					0.719		0.050	0.719
14	4/26/2006	12:00:00	0.005	U	0.034	0.034					0.641	J	0.068	0.641
15	4/26/2006	12:00:00	-0.015	U	0.039	0.039					0.415	J	0.068	0.415
16	4/26/2006	12:00:00	-0.014	U	0.062	0.062					0.579	J	0.070	0.579
17	4/26/2006	12:00:00	0.000	U	0.028	0.028					0.758		0.033	0.758
18	4/26/2006	12:00:00	0.016	U	0.034	0.034					0.272	J	0.071	0.272
mean						0.038				0.194				0.625
std dev						0.009				0.000				0.166
median						0.036				0.194				0.634

Notes:

Information concerning flags associated with the on-site laboratory data can be found in Section 4.3.

Abbreviations and Acronyms:

¹³⁷Cs – cesium-137

MDL – method detection limit

pCi/g – picocuries per gram

²²⁶Ra – radium-226

⁹⁰Sr – strontium-90

std dev – standard deviation

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4.0 LABORATORY ANALYSIS

4.1 SAMPLE PREPARATION

Samples for radiological analysis were collected in the field by trained and qualified radiological technicians. When soil samples were collected in the field, they were first processed through a colander apparatus to eliminate foreign objects and large debris. If the samples were acceptable for processing, an adequate amount of the sample was then placed into the geometry used by the on-site laboratory for analysis. However, if, in the opinion of the field technician, the sample was saturated beyond 10 percent moisture content by weight (as may be indicated by a failure to pass material through the colander apparatus), then approximately four times the amount of sample needed for analysis was placed into a ZipLoc[®] bag for subsequent drying by laboratory personnel.

The field technician who collected the sample turned the samples over to the on-site laboratory using the chain-of-custody (COC) procedure described in the SAP (TtEC 2011). Each sample is verified to contain identical information on the sample container and the associated COC form when received at the laboratory.

Once the samples were received by the on-site laboratory, each sample was verified to contain less than 10 percent moisture content by weight when massed. Samples with moisture in excess of the 10 percent limit were dried in a laboratory oven. Once the moisture content was determined to be less than 10 percent, the sample was passed through consecutively smaller sieves, ending at a number 40, to screen for any foreign materials that may have been present. An aliquot of the remaining materials was then placed and sealed in a 250-milliliter "tuna can" geometry necessary for analysis by the on-site screening laboratory team. Time-critical remediation decisions were based on the conservative results from the on-site screening gamma spectroscopy results. The on-site laboratory analyzed the samples directly for ²²⁶Ra using the EPA 901.1 MOD method and calculating the ²²⁶Ra activity from the 3.6 percent abundant 186.2 kiloelectron-volt (keV) gamma spectrum line for ²²⁶Ra.

The sealed sample containers were then subsequently transferred to a DoD ELAP accredited laboratory (TestAmerica St. Louis) using the COC procedure described in the SAP (TtEC 2011). TestAmerica subsequently quantified the ²²⁶Ra concentration using the EPA 901.1 MOD method. The ²²⁶Ra results were calculated and reported from the 46.09 percent abundant 609.31 keV gamma spectrum line of bismuth-214 (²¹⁴Bi) after an in-growth period of greater than 21 days to allow the ²¹⁴Bi to approach secular equilibrium with ²²⁶Ra for all "definitive data." The definitive data from TestAmerica are included in each SUPR.

4.2 GAMMA SPECTROSCOPY ANALYSIS

Both the on-site screening laboratory and the off-site DoD ELAP accredited laboratory performed gamma spectroscopy analysis using equipment from the same manufacturer. Starting in January 2011, all definitive data gamma spectroscopy analyses were performed by TestAmerica (formerly Severn-Trent Laboratories) in St. Louis, Missouri. TestAmerica is a National Voluntary Laboratory Accreditation Program and Utah certified laboratory, as well as a DoD ELAP accredited laboratory.

Gamma spectroscopy analysis was performed using EG&G ORTEC[®] detector systems equipped with beryllium end caps (windows), which allowed for enhanced quantification of low-energy gammas (such as ²²⁶Ra). Hardware features included a high-purity germanium gamma photon detector supported by a multi-channel analyzer and analysis software. Instrument hardware was calibrated using a multi-energy National Institute of Standards and Technology traceable source ranging from 50 keV to 2.6 megaelectron volts. All results were reported in pCi/g. The Laboratory Manager reviewed all data results, including energy spectrums, for quality assurance (QA) and to verify count integration, efficiency, and background corrections, as well as the identification of overlapping peaks. If there was any question on the analysis results, the sample was counted for a longer interval.

Additional reviews consisted of ensuring that 100 percent of the data complies with the method- and project-specific requirements as outlined in the SAP (TtEC 2011). QA data reviews included checking for compliance with the required QC practices, SOPs, and method and project requirements.

The RASO reviewed the data prior to concurring on release of material, backfilling of trenches, or disposal as low-level radioactive waste.

4.3 GAMMA SPECTROSCOPY ANALYSIS FLAGS

The gamma vision software produces a report once the analysis is complete. Each report is typically eight pages long, with a summary provided on the last page. The summary reports are then presented for each sample in the individual SUPR. The summary reports also identify flags (or symbols) that may be associated with each radionuclide, if appropriate. These flags and their associated meanings are presented below and do not specify that the data are not valid:

- **U – Result is less than the sample detection limit.** The activity calculation performed on the peaks for the isotope of concern yields a lower value than the calculation for the MDL. This identifies that a calculation was performed and the peaks were found, but the resulting activity was lower than the MDL.
- **J – Result is greater than the sample detection limit, but less than the reporting limit.** The calculation performed on the peaks for the isotope of concern yields a higher value than the calculation for the MDL. This identifies that a calculation was

performed and the peaks were found, but the resulting activity reported was lower than the required MDL specified in the SAP (TtEC 2011).

4.4 TOTAL STRONTIUM/STRONTIUM-90 ANALYSIS

The off-site DoD ELAP accredited laboratory (TestAmerica St. Louis) determines total strontium and ^{90}Sr through separation and isotopic measurement. For soils, the strontium is transferred from the soil into a liquid matrix prior to precipitation as insoluble carbonate. Interferences from calcium and other radionuclides are removed by one or more precipitations of the strontium carrier as strontium nitrate. Samples with high dissolved solids can be precipitated as sulfates from an acid solution, eliminating most of the calcium interference. Diethylene triamine pentaacetic acid is added to the samples precipitated as sulfates to further remove interferences. Barium and radium are removed as chromate. The yttrium-90 daughter of ^{90}Sr is removed by a hydroxide precipitation step. The yttrium-90 daughter grows in again and is then separated with stable yttrium carrier as hydroxide and finally precipitated as oxalate and beta counted. Total strontium and ^{90}Sr are counted for beta particle activity by gas flow proportional counters.

Note that in most cases, ^{90}Sr was analyzed for total strontium, which includes ^{89}Sr and ^{90}Sr . If this total strontium result was less than the ^{90}Sr release criterion, this result was conservatively reported at the ^{90}Sr result. However, if the total strontium result was larger than the ^{90}Sr result, the sample was further analyzed using the ^{90}Sr sample analysis procedure described above.

The results of total strontium/ ^{90}Sr analysis were reported in pCi/g and are included as an attachment to each SUPR. Any sample exhibiting ^{137}Cs activity greater than the release criteria was also analyzed for total strontium/ ^{90}Sr .

A minimum of 10 percent of samples were randomly chosen for ^{90}Sr analysis at the DoD ELAP accredited laboratory.

4.5 COUNTING UNCERTAINTY

Measurement of radioactivity has some degree of inherent uncertainty. The uncertainty quoted is the standard deviation of the average, obtained from the statistical uncertainties of the individual measurements. This uncertainty results from the combination of all possible inaccuracies in the measurement process, including such factors as the reading of the result, peak integration interpretation, peak background determination, the calibration of the measurement device, numerical rounding errors, and the random nature of radioactivity. Individual radioactivity measurements are accompanied by a plus or minus (\pm) value, which is an uncertainty term known as either the two-sigma counting error or the total propagated analytical uncertainty.

Total propagated uncertainty includes both counting uncertainty and analytical uncertainty. Because measuring a radionuclide requires a process of counting random radioactive emissions

from a sample, the counting uncertainty gives information on what the measurement might be if the same sample were counted again under identical conditions. The counting uncertainty implies that approximately 95 percent of the time, a recount of the same sample would give a value somewhere between the reported value minus the counting uncertainty and the reported value plus the counting uncertainty.

The uncertainty in the background is not as simple because the background is a calculated number. The background area uncertainty is the uncertainty in the channels used to calculate the end points of the background multiplied by the ratio of the number of channels in the peak to the number of channels used to calculate the background. For wide peaks and low counts per channel, there is high uncertainty in the calculated background.

4.6 DATA ASSESSMENT

Laboratory data were assessed to determine whether the objectives of the survey process were met. The assessment process consisted of four data phases: verification, validation, evaluation, and quality assessment. The assessment of HPNS laboratory data ensured the objective of the survey, final unrestricted release, was met.

4.6.1 Data Verification

Data verification ensured that the requirements were implemented as prescribed. Data verification activities included technical reviews of data and audits, as appropriate.

4.6.2 Data Validation

As stated in the SAP (TtEC 2011), there are no standards for data validation of radiological analyses. Therefore, guidance documents and modified functional guidelines were used in validation of radiological data. Data not meeting method and/or SAP specifications were flagged as estimated or rejected.

Relative percent difference requirements for duplicate samples for the on-site and off-site DoD ELAP accredited laboratories are provided in Worksheet 28.1 of the SAP (TtEC 2011).

4.6.3 Data Evaluation

Radiochemical and laboratory data were evaluated prior to submittal to the RASO. The evaluation of data was based on method requirements and results of QC checks, the level of contamination of method blanks and method spikes (as appropriate), and the overall indication of interference due to contamination. The data qualifiers, if used, were listed at the bottom of the data report.

4.6.4 Data Quality Assessment

Data quality assessment (DQA) is a scientific and statistical evaluation that indicates whether the data are of the right type, quality, and quantity to support their intended use. DQA provides the assessment needed to decide if the planning objectives were met. All data presented in the SUPRs were subject to the DQA process, and the data were determined suitable for use.

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5.0 STATISTICAL TESTS

As stated in Section 8.2.2.1 of MARSSIM (DoD et al. 2000), there is no need to conduct statistical tests when all sample results are less than the release criteria. Because all sample results for the final status survey results for the SUPRS indicated results less than the release criteria, no statistical tests were included in the SUPRS. However, this section describes the process by which the sampling density was determined such that statistical testing, if necessary, would be sufficient.

5.1 DECISION ERRORS

There are two types of decision errors that were used when performing the statistical tests outlined in MARSSIM (DoD et al. 2000). The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. This type of error is sometimes called a "false positive." The probability of a Type I error is denoted by an α . The Type I error is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. This type of error is sometimes called a "false negative." The probability of a Type II error is denoted by a β . The power of a statistical test is defined as the probability of rejecting the null hypothesis when it is actually false. It is numerically equal to $1 - \beta$, where β is the Type II error rate.

Each survey was designed to limit Type I and Type II errors to a maximum probability of 5 percent. It was important to minimize the chances of concluding that a survey unit met the release criteria (reject the null hypothesis) when it actually exceeded the limits (Type I error), and concluding that a survey unit exceeded the release criteria (accept the null hypothesis) when it actually met the limits (Type II error).

5.2 WILCOXON RANK-SUM TEST

The Wilcoxon Rank-Sum (WRS) test is designed to test a hypothesis about the location of a population distribution. It is most often used to test the hypothesis about a population median and often involves the use of matched pairs. For example, reference area and survey unit data were tested for a median difference of zero. This test is also a nonparametric test that may be used when it is only necessary, or possible, to know if observed differences between two conditions were significant. The WRS test is structured to denote a change in magnitude, as opposed to any attempt at the quantitative measurement. Per Section 2.5.1.2 of MARSSIM (DoD et al. 2000), the WRS test is the recommended statistical test for comparison of survey unit radionuclide concentrations with background. Although the WRS test was not conducted for the

SUPRs because the results for all survey units were less than the release criteria, the number of sampling points was calculated to ensure that sufficient sample results from the survey unit areas were available for statistical comparison had all FSS results not all been lower than each release criterion.

5.2.1 Determining the Numbers of Data Points for the WRS Test

Since the ROCs were present in background, N is calculated in the manner specified for the WRS test using Equation 5-1:

Equation 5-1

$$N = \left(\frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2} \right) (1.2)$$

Where:

- $Z_{1-\alpha}$ = 1.645 Type I decision error level
- $Z_{1-\beta}$ = 1.645 Type II decision error level
- P_r = 0.997658 random measurement probability
(from Table 5.1 in MARSSIM [NUREG-1575; DoD et al. 2000])
- (1.2) = 20% increase in number of samples over the minimum

The variable used to calculate N not already specified in the Work Plan (TtEC 2010) was the random measurement probability P_r . P_r in Equation 5-1 above is based on the relative shift. The relative shift is equal to Δ/σ , where Δ was equal to the release criterion minus the lower boundary of the gray region (LBGR), and σ was an estimate of the standard deviation of the measured values in a survey unit. The LBGR was the net median concentration of the contaminant in the survey unit. When this value was unknown, half the value of the release criterion was used as the LBGR, as suggested in MARSSIM (DoD et al. 2000). Likewise, σ was assigned the value of the standard deviation of the measurement values in the reference area.

Using Equation 5-2 below, the value for Δ was derived by converting the release criterion from pCi/g to counts per second (cps). To perform this conversion, an arbitrary concentration of ^{226}Ra is divided by the associated exposure rate produced by this concentration of ^{226}Ra . The resulting number was then divided by the average net cps per microrentgen per hour ($\mu\text{R/h}$) for the detectors on the towed array. Once this number was derived, the release criterion of 1.0 pCi/g for ^{226}Ra was divided by this number.

Equation 5-2

$$RC \text{ in cpm} = \frac{RC}{AC/ER * 1/CR}$$

Where:

RC = release criterion (pCi/g)
 AC = arbitrary concentration of ^{226}Ra (pCi/g)
 ER = exposure rate for 1 pCi/g ^{226}Ra calculated by Microshield®
 CR = counts per second per $\mu\text{R/h}$ for the detector

Where:

RC = 1.0
 AC = 1
 ER = 0.7384
 CR = 436

The values used for these parameters to determine a P , were 322 cps for the release criterion. Taking half of this value, 161 cps for Δ , and using 30 cps for σ , N was calculated as nine samples when using Equation 5-1.

5.2.2 Determining Data Points for Small Areas of Elevated Activity

The statistical test described above evaluated whether or not the residual radioactivity in the survey unit exceeded the release criterion for contamination conditions that were approximately uniform across the survey unit. To obtain reasonable assurance that any small areas of elevated residual radioactivity were not missed during the survey, the total number of samples was increased. Equation 5-3 was used to determine the number of samples. The required number of samples, n_{EA} , was developed for an area of elevated activity based on a survey unit size of 1,000 square meters and a triangular grid with spacing, L , of 8 meters. Substituting these values into the following equation, n_{EA} was calculated to be 18.

Equation 5-3

$$L = \sqrt{\frac{A}{0.866 n_{EA}}}$$

Where:

L = length of spacing (meters)
 0.866 = factor presented in MARSSIM
 A = surface area of the survey unit (1,000 square meters)
 n_{EA} = number of samples

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6.0 DOSE MODELING

The intent of a SUPR is to achieve unrestricted release for the associated survey unit. In doing so, the most conservative approach was used to model the area using the most current version of RESRAD. The default residential farmer scenario was used with only two minor changes. The first is that the actual surface area of the trench unit was used (in square meters). The second is that modeling was performed using the mean concentrations of ^{137}Cs , ^{226}Ra (with the lead-210 daughter), and ^{90}Sr using the actual activity and replacing it with the MDL value if the reported activity was less than the MDL. The activity used to model for ^{226}Ra was based on the isotopic net concentration (survey unit mean isotopic concentration minus background mean isotopic concentration). No background is subtracted from the ^{137}Cs or ^{90}Sr values, as these radionuclides are not naturally occurring or expected at drain piping depths from global fallout from nuclear weapons testing.

The default parameters included external and inhalation exposures and exposure from the following ingestion pathways: drinking water, food grown with contaminated irrigation water, food grown on contaminated soil, fish, and inadvertent ingestion of soil. Land-based foods considered were leafy vegetables, root vegetables, fruit, grain, beef, poultry, milk, and eggs. Animal feeds included fresh forage, as well as stored grain and hay. This was the most conservative scenario as it assumed that persons living on the site can use the land for any purpose without land use restrictions.

If none of the concentrations for the ROCs for the specific survey unit were greater than zero, the net dose and increased health risk for the survey unit were expected to be negligible, and no further modeling was determined to be reasonable or prudent.

The final dose and health risk modeling summary, if needed, will be included in each SUPR. Demonstration of both a net residual dose of less than 15 millirems per year and a net increased health risk of less than 3×10^{-4} to the average member of the critical group (or member of the public) will be considered sufficient for unrestricted release of the survey unit.

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7.0 RECOMMENDATION OF FINAL UNRESTRICTED RELEASE

A SUPR will be prepared for each survey unit with recommendations for free release. Each SUPR will provide general background information about the trench unit and associated ESU(s) that are part of the survey unit package. Any exceptions to the ROCs will be addressed in each SUPR.

A discussion of the FSS will include the activities performed for the trench unit and each ESU or import fill that was used for backfill. The discussion will include results of the soil samples. Gamma scan data will be provided as attachments in each SUPR.

The version of RESRAD used and the results of the dose and risk modeling will be provided as an attachment and discussed in each SUPR.

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8.0 REFERENCES

- DoD (Department of Defense), Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). NUREG-1575. August.
- DON (Department of the Navy). 2006. Final Base-wide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California.
- NAVSEA (Naval Sea Systems Command). 2004. Final Historical Radiological Assessment, Volume II.
- NCRP (National Council on Radiation Protection and Measurements). 1993. The National Council on Radiation Protection and Measurements, Report Number 116.
- NRC (Nuclear Regulatory Commission). 1997. Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions Guide (NUREG-1507).
- . 1998. Nonparametric Statistical Methodology for the Design and Analysis of the Final Status Decommissioning Survey Guide (NUREG 1505).
- TtEC (Tetra Tech EC, Inc.). 2008. Final Project Work Plan, Revision 3. Base-wide Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California. November 30.
- . 2010. Final Project Work Plan, Revision 4. Base-Wide Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California. June 30.
- . 2011. Final Execution Plan, Revision 1, Attachment 1: Sampling and Analysis Plan, Basewide Radiological Support, Hunters Point Naval Shipyard, San Francisco, California. July 2011.

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ATTACHMENT 1
IMPORT FILL MATERIAL
SAMPLE RESULTS

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MILLS PENINSULA BACKFILL

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-001

Radiochemistry

Lab Sample ID: F1F020457-002
 Work Order: MJ0D2
 Matrix: SOLID

Date Collected: 02/19/07 0730
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138		Yld %
Actinium 228	0.443		0.161		0.117	30	06/03/11	06/17/11
Americium 241	-0.0101	U	0.122		0.100	30	06/03/11	06/17/11
Bismuth 212	0.193	U	0.343		0.263	30	06/03/11	06/17/11
Bismuth 214	0.533		0.173		0.074	30	06/03/11	06/17/11
Cesium 137	-0.00174	U	0.0353	0.0700	0.028	30	06/03/11	06/17/11
Cobalt 60	0.0330		0.0469		0.031	30	06/03/11	06/17/11
Europium 152	0.00131	U	0.107		0.088	30	06/03/11	06/17/11
Europium 154	-0.0205	U	0.358		0.291	30	06/03/11	06/17/11
Lead 210	0.638	U	1.48	1.50	1.15	30	06/03/11	06/17/11
Lead 212	0.466		0.133		0.068	30	06/03/11	06/17/11
Lead 214	0.479		0.132		0.065	30	06/03/11	06/17/11
Potassium 40	6.21		1.39		0.525	30	06/03/11	06/17/11
Protactinium 234	-0.0452	U	0.151		0.121	30	06/03/11	06/17/11
Radium (226)	0.533	J	0.173	0.700	0.074	30	06/03/11	06/17/11
Thallium 208	0.156		0.0545		0.027	30	06/03/11	06/17/11
Thorium 232	0.443		0.161		0.117	30	06/03/11	06/17/11
Thorium 234	0.304	U	1.14		0.964	30	06/03/11	06/17/11
Uranium 235	-0.0522	U	15.3		0.209	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-002

Radiochemistry

Lab Sample ID: F1F020457-003
 Work Order: MJ0D7
 Matrix: SOLID

Date Collected: 02/19/07 0740
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.297		0.181		0.107	30	06/03/11	06/17/11
Americium 241	0.0342	U	0.101		0.080	30	06/03/11	06/17/11
Bismuth 212	0.233	U	0.329		0.237	30	06/03/11	06/17/11
Bismuth 214	0.569		0.144		0.050	30	06/03/11	06/17/11
Cesium 137	0.00618	U	0.0442	0.0700	0.035	30	06/03/11	06/17/11
Cobalt 60	0.0	U	0.0104		0.012	30	06/03/11	06/17/11
Europium 152	-0.0400	U	0.113		0.088	30	06/03/11	06/17/11
Europium 154	0.0959	U	0.321		0.249	30	06/03/11	06/17/11
Lead 210	0.352	U	1.16	1.50	0.929	30	06/03/11	06/17/11
Lead 212	0.366		0.123		0.061	30	06/03/11	06/17/11
Lead 214	0.638		0.130		0.053	30	06/03/11	06/17/11
Potassium 40	7.52		1.34		0.246	30	06/03/11	06/17/11
Protactinium 234	0.0191	U	0.127		0.104	30	06/03/11	06/17/11
Radium (226)	0.569	J	0.144	0.700	0.050	30	06/03/11	06/17/11
Thallium 208	0.0687		0.0465		0.030	30	06/03/11	06/17/11
Thorium 232	0.297		0.181		0.107	30	06/03/11	06/17/11
Thorium 234	0.476	U	0.902		0.710	30	06/03/11	06/17/11
Uranium 235	0.0836	U	0.217		0.173	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 Kev line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-003

Radiochemistry

Lab Sample ID: F1F020457-004
 Work Order: MJ0D8
 Matrix: SOLID

Date Collected: 02/19/07 0750
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.425		0.220		0.137	30	06/03/11	06/17/11
Americium 241	-0.0221	U	0.116		0.094	30	06/03/11	06/17/11
Bismuth 212	0.200	U	0.361		0.268	30	06/03/11	06/17/11
Bismuth 214	0.761		0.190		0.072	30	06/03/11	06/17/11
Cesium 137	0.0257	U	0.0486	0.0700	0.036	30	06/03/11	06/17/11
Cobalt 60	-0.0204	U	0.0686		0.053	30	06/03/11	06/17/11
Europium 152	-0.0379	U	0.139		0.111	30	06/03/11	06/17/11
Europium 154	-0.145	U	0.446		0.349	30	06/03/11	06/17/11
Lead 210	-0.178	U	1.85	1.50	1.25	30	06/03/11	06/17/11
Lead 212	0.465		0.129		0.064	30	06/03/11	06/17/11
Lead 214	0.544		0.140		0.059	30	06/03/11	06/17/11
Potassium 40	8.16		1.48		0.471	30	06/03/11	06/17/11
Protactinium 234	-0.0243	U	0.148		0.120	30	06/03/11	06/17/11
Radium (226)	0.761		0.190	0.700	0.072	30	06/03/11	06/17/11
Thallium 208	0.178		0.0625		0.028	30	06/03/11	06/17/11
Thorium 232	0.425		0.220		0.137	30	06/03/11	06/17/11
Thorium 234	1.40		1.45		0.966	30	06/03/11	06/17/11
Uranium 235	0.141	U	0.276		0.221	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-004

Radiochemistry

Lab Sample ID: F1F020457-005
 Work Order: MJ0EA
 Matrix: SOLID

Date Collected: 02/19/07 0800
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	0.481		0.175		0.141	30	06/03/11	06/17/11
Americium 241	-0.00143	U	0.116		0.095	30	06/03/11	06/17/11
Bismuth 212	0.157	U	0.353		0.265	30	06/03/11	06/17/11
Bismuth 214	0.605		0.160		0.062	30	06/03/11	06/17/11
Cesium 137	0.0112	U	0.0459	0.0700	0.036	30	06/03/11	06/17/11
Cobalt 60	0.0130	U	0.0477		0.036	30	06/03/11	06/17/11
Europium 152	-0.0370	U	0.145		0.116	30	06/03/11	06/17/11
Europium 154	0.218	U	0.392		0.288	30	06/03/11	06/17/11
Lead 210	0.974	J	1.26	1.50	0.913	30	06/03/11	06/17/11
Lead 212	0.409		0.125		0.078	30	06/03/11	06/17/11
Lead 214	0.630		0.140		0.071	30	06/03/11	06/17/11
Potassium 40	5.45		1.43		0.682	30	06/03/11	06/17/11
Protactinium 234	0.0409	U	0.124		0.098	30	06/03/11	06/17/11
Radium (226)	0.605	J	0.160	0.700	0.062	30	06/03/11	06/17/11
Thallium 208	0.143		0.0698		0.045	30	06/03/11	06/17/11
Thorium 232	0.481		0.175		0.141	30	06/03/11	06/17/11
Thorium 234	0.395	U	1.18		0.986	30	06/03/11	06/17/11
Uranium 235	0.186	U	0.247		0.192	30	06/03/11	06/17/11

NOTE(S)

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 Bold results are greater than the MDL.

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-005

Radiochemistry

Lab Sample ID: F1F020457-006
 Work Order: MJ0EC
 Matrix: SOLID

Date Collected: 02/19/07 0810
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	0.222		0.226		0.143	30	06/03/11	06/17/11
Americium 241	-0.0554	U	0.153		0.123	30	06/03/11	06/17/11
Bismuth 212	0.0	U	0.523		0.431	30	06/03/11	06/17/11
Bismuth 214	0.648		0.201		0.067	30	06/03/11	06/17/11
Cesium 137	0.0	U	0.0716	0.0700	0.059	30	06/03/11	06/17/11
Cobalt 60	0.000161	U	0.0743		0.061	30	06/03/11	06/17/11
Europium 152	-0.0553	U	0.171		0.134	30	06/03/11	06/17/11
Europium 154	0.182	U	0.493		0.372	30	06/03/11	06/17/11
Lead 210	0.775	U	1.53	1.50	1.19	30	06/03/11	06/17/11
Lead 212	0.396		0.151		0.076	30	06/03/11	06/17/11
Lead 214	0.640		0.182		0.065	30	06/03/11	06/17/11
Potassium 40	8.20		1.87		0.486	30	06/03/11	06/17/11
Protactinium 234	-0.0667	U	0.203		0.162	30	06/03/11	06/17/11
Radium (226)	0.648	J	0.201	0.700	0.067	30	06/03/11	06/17/11
Thallium 208	0.0654		0.0714		0.052	30	06/03/11	06/17/11
Thorium 232	0.222		0.226		0.143	30	06/03/11	06/17/11
Thorium 234	0.341	U	1.30		1.12	30	06/03/11	06/17/11
Uranium 235	0.279		0.304		0.234	30	06/03/11	06/17/11

NOTE(S)

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J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 Kev line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-007

Radiochemistry

Lab Sample ID: F1F020457-007
 Work Order: MJOED
 Matrix: SOLID

Date Collected: 02/19/07 0830
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	0.490		0.222		0.124	30	06/03/11	06/23/11
Americium 241	-0.00754	U	0.156		0.128	30	06/03/11	06/23/11
Bismuth 212	0.300		0.424		0.296	30	06/03/11	06/23/11
Bismuth 214	0.573		0.171		0.042	30	06/03/11	06/23/11
Cesium 137	0.000517	U	0.0534	0.0700	0.043	30	06/03/11	06/23/11
Cobalt 60	0.0116	U	0.0340		0.023	30	06/03/11	06/23/11
Europium 152	0.142		0.145		0.104	30	06/03/11	06/23/11
Europium 154	0.251		0.344		0.219	30	06/03/11	06/23/11
Lead 210	0.522	U	1.47	1.50	1.18	30	06/03/11	06/23/11
Lead 212	0.486		0.144		0.067	30	06/03/11	06/23/11
Lead 214	0.548		0.156		0.052	30	06/03/11	06/23/11
Potassium 40	8.25		1.73		0.325	30	06/03/11	06/23/11
Protactinium 234	0.0956	U	0.175		0.137	30	06/03/11	06/23/11
Radium (226)	0.573	J	0.171	0.700	0.042	30	06/03/11	06/23/11
Thallium 208	0.125		0.0810		0.054	30	06/03/11	06/23/11
Thorium 232	0.490		0.222		0.124	30	06/03/11	06/23/11
Thorium 234	0.0967	U	0.581		1.03	30	06/03/11	06/23/11
Uranium 235	0.0105	U	0.0192		0.232	30	06/03/11	06/23/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-008

Radiochemistry

Lab Sample ID: F1F020457-008
 Work Order: MJ0EE
 Matrix: SOLID

Date Collected: 02/19/07 0840
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.737		0.215		0.035	30	06/03/11	06/23/11
Americium 241	-0.0277	U	0.115		0.093	30	06/03/11	06/23/11
Bismuth 212	0.260	U	0.403		0.297	30	06/03/11	06/23/11
Bismuth 214	0.438		0.150		0.082	30	06/03/11	06/23/11
Cesium 137	0.0159	U	0.0427	0.0700	0.032	30	06/03/11	06/23/11
Cobalt 60	-0.000907	U	0.0610		0.050	30	06/03/11	06/23/11
Europium 152	0.0840	U	0.141		0.102	30	06/03/11	06/23/11
Europium 154	0.0442	U	0.163		0.287	30	06/03/11	06/23/11
Lead 210	0.252	U	1.35	1.50	1.17	30	06/03/11	06/23/11
Lead 212	0.514		0.149		0.071	30	06/03/11	06/23/11
Lead 214	0.379		0.124		0.080	30	06/03/11	06/23/11
Potassium 40	9.73		1.65		0.347	30	06/03/11	06/23/11
Protactinium 234	0.0421	U	0.0997		0.122	30	06/03/11	06/23/11
Radium (226)	0.438	J	0.150	0.700	0.082	30	06/03/11	06/23/11
Thallium 208	0.0948		0.0535		0.036	30	06/03/11	06/23/11
Thorium 232	0.737		0.215		0.035	30	06/03/11	06/23/11
Thorium 234	1.53		1.23		0.767	30	06/03/11	06/23/11
Uranium 235	0.124	U	0.224		0.197	30	06/03/11	06/23/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-009

Radiochemistry

Lab Sample ID: F1F020457-009
 Work Order: MJ0EF
 Matrix: SOLID

Date Collected: 02/19/07 0850
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	-0.108	U	0.992		0.143	30	06/03/11	06/17/11
Americium 241	-0.0427	U	0.113		0.090	30	06/03/11	06/17/11
Bismuth 212	0.224	U	0.356		0.262	30	06/03/11	06/17/11
Bismuth 214	0.489		0.146		0.066	30	06/03/11	06/17/11
Cesium 137	0.0198	U	0.0478	0.0700	0.036	30	06/03/11	06/17/11
Cobalt 60	0.0236	U	0.0452		0.032	30	06/03/11	06/17/11
Europium 152	0.110		0.107		0.073	30	06/03/11	06/17/11
Europium 154	0.0	U	0.0632		0.073	30	06/03/11	06/17/11
Lead 210	-0.423	U	2.57	1.50	1.13	30	06/03/11	06/17/11
Lead 212	0.428		0.119		0.059	30	06/03/11	06/17/11
Lead 214	0.440		0.118		0.054	30	06/03/11	06/17/11
Potassium 40	7.66		1.48		0.597	30	06/03/11	06/17/11
Protactinium 234	-0.0423	U	0.146		0.118	30	06/03/11	06/17/11
Radium (226)	0.489	J	0.146	0.700	0.066	30	06/03/11	06/17/11
Thallium 208	0.107		0.0603		0.040	30	06/03/11	06/17/11
Thorium 232	-0.108	U	0.992		0.143	30	06/03/11	06/17/11
Thorium 234	0.891		0.506		0.741	30	06/03/11	06/17/11
Uranium 235	-0.141	U	0.444		0.192	30	06/03/11	06/17/11

NOTE(S)

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 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-010

Radiochemistry

Lab Sample ID: F1F020457-010
 Work Order: MJ0EH
 Matrix: SOLID

Date Collected: 02/19/07 0900
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138		Yld %
Actinium 228	0.225		0.209		0.145	30	06/03/11	06/17/11
Americium 241	0.0549	U	0.0896		0.069	30	06/03/11	06/17/11
Bismuth 212	0.214	U	0.350		0.258	30	06/03/11	06/17/11
Bismuth 214	0.330		0.129		0.063	30	06/03/11	06/17/11
Cesium 137	-0.0180	U	0.0460	0.0700	0.035	30	06/03/11	06/17/11
Cobalt 60	0.0262		0.0352		0.021	30	06/03/11	06/17/11
Europium 152	-0.0325	U	0.119		0.094	30	06/03/11	06/17/11
Europium 154	0.104	U	0.346		0.269	30	06/03/11	06/17/11
Lead 210	-0.270	U	1.69	1.50	0.918	30	06/03/11	06/17/11
Lead 212	0.403		0.131		0.064	30	06/03/11	06/17/11
Lead 214	0.373		0.108		0.048	30	06/03/11	06/17/11
Potassium 40	7.35		1.36		0.316	30	06/03/11	06/17/11
Protactinium 234	-0.0155	U	0.145		0.118	30	06/03/11	06/17/11
Radium (226)	0.330	J	0.129	0.700	0.063	30	06/03/11	06/17/11
Thallium 208	0.135		0.0469		0.020	30	06/03/11	06/17/11
Thorium 232	0.225		0.209		0.145	30	06/03/11	06/17/11
Thorium 234	0.808		0.826		0.662	30	06/03/11	06/17/11
Uranium 235	0.0764	U	0.185		0.149	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-006

Radiochemistry

Lab Sample ID: F1F020457-011
 Work Order: MJ0EJ
 Matrix: SOLID

Date Collected: 02/19/07 0820
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.195		0.220		0.155	30	06/03/11	06/17/11
Americium 241	0.0501	U	0.107		0.084	30	06/03/11	06/17/11
Bismuth 212	0.414		0.465		0.327	30	06/03/11	06/17/11
Bismuth 214	0.705		0.182		0.072	30	06/03/11	06/17/11
Cesium 137	0.0198	U	0.0610	0.0700	0.047	30	06/03/11	06/17/11
Cobalt 60	-0.0302	U	0.0765		0.058	30	06/03/11	06/17/11
Europium 152	-0.0230	U	0.133		0.107	30	06/03/11	06/17/11
Europium 154	0.0157	U	0.325		0.265	30	06/03/11	06/17/11
Lead 210	0.612	U	1.52	1.50	1.29	30	06/03/11	06/17/11
Lead 212	0.543		0.136		0.063	30	06/03/11	06/17/11
Lead 214	0.633		0.177		0.083	30	06/03/11	06/17/11
Potassium 40	8.03		1.71		0.511	30	06/03/11	06/17/11
Protactinium 234	-0.0724	U	0.186		0.148	30	06/03/11	06/17/11
Radium (226)	0.705		0.182	0.700	0.072	30	06/03/11	06/17/11
Thallium 208	0.156		0.0768		0.039	30	06/03/11	06/17/11
Thorium 232	0.195		0.220		0.155	30	06/03/11	06/17/11
Thorium 234	0.362	U	1.21		1.02	30	06/03/11	06/17/11
Uranium 235	0.0459	U	0.251		0.207	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-011

Radiochemistry

Lab Sample ID: F1F020457-012
 Work Order: MJ0EK
 Matrix: SOLID

Date Collected: 02/19/07 0910
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	0.511		0.204		0.137	30	06/03/11	06/17/11
Americium 241	0.0	U	0.146		0.120	30	06/03/11	06/17/11
Bismuth 212	0.235	U	0.488		0.366	30	06/03/11	06/17/11
Bismuth 214	0.520		0.167		0.044	30	06/03/11	06/17/11
Cesium 137	0.000621	U	0.0482	0.0700	0.039	30	06/03/11	06/17/11
Cobalt 60	0.00643	U	0.0747		0.060	30	06/03/11	06/17/11
Europium 152	-0.0436	U	0.156		0.124	30	06/03/11	06/17/11
Europium 154	-0.0933	U	0.544		0.434	30	06/03/11	06/17/11
Lead 210	1.00	U	1.35	1.50	1.03	30	06/03/11	06/17/11
Lead 212	0.448		0.153		0.068	30	06/03/11	06/17/11
Lead 214	0.492		0.134		0.040	30	06/03/11	06/17/11
Potassium 40	10.7		2.00		0.329	30	06/03/11	06/17/11
Protactinium 234	0.00608	U	0.183		0.150	30	06/03/11	06/17/11
Radium (226)	0.520	J	0.167	0.700	0.044	30	06/03/11	06/17/11
Thallium 208	0.121		0.0671		0.039	30	06/03/11	06/17/11
Thorium 232	0.511		0.204		0.137	30	06/03/11	06/17/11
Thorium 234	-0.0164	U	1.15		0.981	30	06/03/11	06/17/11
Uranium 235	-0.119	U	1.25		0.237	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-012

Radiochemistry

Lab Sample ID: F1F020457-013
 Work Order: MJOEN
 Matrix: SOLID

Date Collected: 02/19/07 0920
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.398		0.140		0.092	30	06/03/11	06/17/11
Americium 241	0.0	U	0.107		0.087	30	06/03/11	06/17/11
Bismuth 212	0.178	U	0.369		0.282	30	06/03/11	06/17/11
Bismuth 214	0.512		0.119		0.038	30	06/03/11	06/17/11
Cesium 137	0.000772	U	0.0355	0.0700	0.029	30	06/03/11	06/17/11
Cobalt 60	0.0	U	0.0549		0.045	30	06/03/11	06/17/11
Europium 152	0.0	U	0.141		0.116	30	06/03/11	06/17/11
Europium 154	-0.0147	U	0.324		0.264	30	06/03/11	06/17/11
Lead 210	0.571	U	1.05	1.50	0.817	30	06/03/11	06/17/11
Lead 212	0.431		0.130		0.060	30	06/03/11	06/17/11
Lead 214	0.677		0.129		0.050	30	06/03/11	06/17/11
Potassium 40	9.75		1.53		0.269	30	06/03/11	06/17/11
Protactinium 234	-0.0486	U	0.142		0.114	30	06/03/11	06/17/11
Radium (226)	0.512	J	0.119	0.700	0.038	30	06/03/11	06/17/11
Thallium 208	0.138		0.0505		0.020	30	06/03/11	06/17/11
Thorium 232	0.398		0.140		0.092	30	06/03/11	06/17/11
Thorium 234	0.284	U	0.984		0.794	30	06/03/11	06/17/11
Uranium 235	0.0923	U	0.180		0.140	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-013

Radiochemistry

Lab Sample ID: F1F020457-014
 Work Order: MJOEP
 Matrix: SOLID

Date Collected: 02/19/07 0930
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.432		0.204		0.112	30	06/03/11	06/21/11
Americium 241	0.103		0.0968		0.072	30	06/03/11	06/21/11
Bismuth 212	0.220	U	0.341		0.250	30	06/03/11	06/21/11
Bismuth 214	0.427		0.122		0.047	30	06/03/11	06/21/11
Cesium 137	0.0147	U	0.0429	0.0700	0.033	30	06/03/11	06/21/11
Cobalt 60	0.0	U	0.0551		0.045	30	06/03/11	06/21/11
Europium 152	0.0349	U	0.106		0.083	30	06/03/11	06/21/11
Europium 154	0.0	U	0.498		0.411	30	06/03/11	06/21/11
Lead 210	-0.0684	U	1.14	1.50	0.932	30	06/03/11	06/21/11
Lead 212	0.477		0.113		0.046	30	06/03/11	06/21/11
Lead 214	0.496		0.122		0.063	30	06/03/11	06/21/11
Potassium 40	10.0		1.56		0.242	30	06/03/11	06/21/11
Protactinium 234	0.0587	U	0.124		0.098	30	06/03/11	06/21/11
Radium (226)	0.427	J	0.122	0.700	0.047	30	06/03/11	06/21/11
Thallium 208	0.179		0.0505		0.014	30	06/03/11	06/21/11
Thorium 232	0.432		0.204		0.112	30	06/03/11	06/21/11
Thorium 234	0.948		0.905		0.680	30	06/03/11	06/21/11
Uranium 235	-0.0144	U	0.241		0.197	30	06/03/11	06/21/11

NOTE(S)

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 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-014

Radiochemistry

Lab Sample ID: F1F020457-015
 Work Order: MJOER
 Matrix: SOLID

Date Collected: 02/19/07 0940
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.508		0.128		0.027	30	06/03/11	06/17/11
Americium 241	0.0256	U	0.0795		0.063	30	06/03/11	06/17/11
Bismuth 212	0.167	U	0.255		0.182	30	06/03/11	06/17/11
Bismuth 214	0.438		0.129		0.050	30	06/03/11	06/17/11
Cesium 137	-0.00489	U	0.0377	0.0700	0.030	30	06/03/11	06/17/11
Cobalt 60	-0.0183	U	0.0508		0.039	30	06/03/11	06/17/11
Europium 152	-0.0199	U	0.100		0.080	30	06/03/11	06/17/11
Europium 154	-0.0667	U	0.300		0.237	30	06/03/11	06/17/11
Lead 210	0.575	U	0.955	1.50	0.742	30	06/03/11	06/17/11
Lead 212	0.322		0.102		0.047	30	06/03/11	06/17/11
Lead 214	0.552		0.130		0.048	30	06/03/11	06/17/11
Potassium 40	8.50		1.43		0.314	30	06/03/11	06/17/11
Protactinium 234	-0.0433	U	0.128		0.103	30	06/03/11	06/17/11
Radium (226)	0.438	J	0.129	0.700	0.050	30	06/03/11	06/17/11
Thallium 208	0.0582		0.0427		0.029	30	06/03/11	06/17/11
Thorium 232	0.508		0.128		0.027	30	06/03/11	06/17/11
Thorium 234	0.886		0.869		0.660	30	06/03/11	06/17/11
Uranium 235	0.0442	U	0.184		0.148	30	06/03/11	06/17/11

NOTE (S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-015

Radiochemistry

Lab Sample ID: F1F020457-016
 Work Order: MJOET
 Matrix: SOLID

Date Collected: 02/19/07 0950
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	-0.00593	U	0.251		0.206	30	06/03/11	06/17/11
Americium 241	0.0264	U	0.119		0.097	30	06/03/11	06/17/11
Bismuth 212	0.118	U	0.474		0.369	30	06/03/11	06/17/11
Bismuth 214	0.429		0.172		0.072	30	06/03/11	06/17/11
Cesium 137	-0.00299	U	0.0835	0.0700	0.062	30	06/03/11	06/17/11
Cobalt 60	-0.0245	U	0.980		0.037	30	06/03/11	06/17/11
Europium 152	-0.0295	U	0.145		0.115	30	06/03/11	06/17/11
Europium 154	-0.158	U	0.575		0.446	30	06/03/11	06/17/11
Lead 210	-0.119	U	1.55	1.50	1.15	30	06/03/11	06/17/11
Lead 212	0.538		0.150		0.060	30	06/03/11	06/17/11
Lead 214	0.677		0.180		0.062	30	06/03/11	06/17/11
Potassium 40	6.45		1.82		0.582	30	06/03/11	06/17/11
Protactinium 234	0.0147	U	0.100		0.080	30	06/03/11	06/17/11
Radium (226)	0.429	J	0.172	0.700	0.072	30	06/03/11	06/17/11
Thallium 208	0.324		0.106		0.034	30	06/03/11	06/17/11
Thorium 232	-0.00593	U	0.251		0.206	30	06/03/11	06/17/11
Thorium 234	1.16		1.08		0.850	30	06/03/11	06/17/11
Uranium 235	0.164	U	0.226		0.167	30	06/03/11	06/17/11

NOTE(S)

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J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-016

Radiochemistry

Lab Sample ID: F1F020457-017
 Work Order: MJ0EV
 Matrix: SOLID

Date Collected: 02/19/07 1000
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138	Yld %	
Actinium 228	0.629		0.187		0.036	30	06/03/11	06/21/11
Americium 241	-0.0590	U	0.119		0.094	30	06/03/11	06/21/11
Bismuth 212	0.131	U	0.416		0.325	30	06/03/11	06/21/11
Bismuth 214	0.405		0.141		0.080	30	06/03/11	06/21/11
Cesium 137	-0.0184	U	0.0632	0.0700	0.050	30	06/03/11	06/21/11
Cobalt 60	-0.0121	U	0.0713		0.057	30	06/03/11	06/21/11
Europium 152	-0.0261	U	0.133		0.107	30	06/03/11	06/21/11
Europium 154	-0.000958	U	0.375		0.308	30	06/03/11	06/21/11
Lead 210	1.08	J	1.30	1.50	0.948	30	06/03/11	06/21/11
Lead 212	0.477		0.122		0.057	30	06/03/11	06/21/11
Lead 214	0.559		0.139		0.072	30	06/03/11	06/21/11
Potassium 40	9.28		1.64		0.364	30	06/03/11	06/21/11
Protactinium 234	-0.0509	U	0.145		0.116	30	06/03/11	06/21/11
Radium (226)	0.405	J	0.141	0.700	0.080	30	06/03/11	06/21/11
Thallium 208	0.140		0.0582		0.028	30	06/03/11	06/21/11
Thorium 232	0.629		0.187		0.036	30	06/03/11	06/21/11
Thorium 234	0.515	U	1.13		0.939	30	06/03/11	06/21/11
Uranium 235	0.201		0.240		0.184	30	06/03/11	06/21/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-017

Radiochemistry

Lab Sample ID: F1F020457-018
 Work Order: MJ0EW
 Matrix: SOLID

Date Collected: 02/19/07 1010
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154138		Yld %
Actinium 228	0.540		0.221		0.106	30	06/03/11	06/17/11
Americium 241	0.000443	U	0.107		0.087	30	06/03/11	06/17/11
Bismuth 212	0.148	U	0.368		0.282	30	06/03/11	06/17/11
Bismuth 214	0.682		0.167		0.061	30	06/03/11	06/17/11
Cesium 137	0.0	U	0.0532	0.0700	0.043	30	06/03/11	06/17/11
Cobalt 60	-0.00115	U	0.0532		0.043	30	06/03/11	06/17/11
Europium 152	0.00757	U	0.0848		0.068	30	06/03/11	06/17/11
Europium 154	0.00541	U	0.313		0.257	30	06/03/11	06/17/11
Lead 210	-0.0767	U	1.28	1.50	1.05	30	06/03/11	06/17/11
Lead 212	0.408		0.123		0.057	30	06/03/11	06/17/11
Lead 214	0.737		0.155		0.048	30	06/03/11	06/17/11
Potassium 40	8.96		1.55		0.304	30	06/03/11	06/17/11
Protactinium 234	0.0	U	0.180		0.148	30	06/03/11	06/17/11
Radium (226)	0.682	J	0.167	0.700	0.061	30	06/03/11	06/17/11
Thallium 208	0.233		0.0606		0.015	30	06/03/11	06/17/11
Thorium 232	0.540		0.221		0.106	30	06/03/11	06/17/11
Thorium 234	0.611	U	0.932		0.724	30	06/03/11	06/17/11
Uranium 235	-0.0386	U	0.231		0.188	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

Tetra Tech EC, Inc.

Client Sample ID: 6PBIF002-018

Radiochemistry

Lab Sample ID: F1F020457-019
 Work Order: MJOEX
 Matrix: SOLID

Date Collected: 02/19/07 1020
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154138		Yld %	
Actinium 228	0.449		0.179		0.066	30	06/03/11	06/17/11
Americium 241	0.0364	U	0.107		0.085	30	06/03/11	06/17/11
Bismuth 212	0.303	U	0.436		0.329	30	06/03/11	06/17/11
Bismuth 214	0.616		0.161		0.060	30	06/03/11	06/17/11
Cesium 137	0.00434	U	0.0474	0.0700	0.038	30	06/03/11	06/17/11
Cobalt 60	0.0	U	0.0646		0.053	30	06/03/11	06/17/11
Europium 152	-0.0365	U	0.131		0.104	30	06/03/11	06/17/11
Europium 154	0.0279	U	0.361		0.293	30	06/03/11	06/17/11
Lead 210	-0.415	U	2.27	1.50	1.44	30	06/03/11	06/17/11
Lead 212	0.493		0.116		0.058	30	06/03/11	06/17/11
Lead 214	0.525		0.124		0.064	30	06/03/11	06/17/11
Potassium 40	8.39		1.61		0.533	30	06/03/11	06/17/11
Protactinium 234	-0.0317	U	0.137		0.111	30	06/03/11	06/17/11
Radium (226)	0.616	J	0.161	0.700	0.060	30	06/03/11	06/17/11
Thallium 208	0.202		0.0618		0.027	30	06/03/11	06/17/11
Thorium 232	0.449		0.179		0.066	30	06/03/11	06/17/11
Thorium 234	0.717	U	1.08		0.892	30	06/03/11	06/17/11
Uranium 235	-0.162	U	0.531		0.215	30	06/03/11	06/17/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020457

JERICO BACKFILL

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-001

Radiochemistry

Lab Sample ID: F1F020455-001
 Work Order: MJOCQ
 Matrix: SOLID

Date Collected: 05/13/11 1000
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.237		0.153		0.086	30	06/03/11	06/16/11
Americium 241	0.00712	U	0.0852		0.069	30	06/03/11	06/16/11
Bismuth 212	0.140	U	0.298		0.224	30	06/03/11	06/16/11
Bismuth 214	0.369		0.111		0.045	30	06/03/11	06/16/11
Cesium 137	0.0124	U	0.0414	0.0700	0.032	30	06/03/11	06/16/11
Cobalt 60	0.0	U	0.0767		0.063	30	06/03/11	06/16/11
Europium 152	0.00712	U	0.101		0.082	30	06/03/11	06/16/11
Europium 154	0.0476	U	0.296		0.236	30	06/03/11	06/16/11
Lead 210	-0.00360	U	0.930	1.50	0.766	30	06/03/11	06/16/11
Lead 212	0.368		0.114		0.055	30	06/03/11	06/16/11
Lead 214	0.395		0.120		0.059	30	06/03/11	06/16/11
Potassium 40	10.8		1.62		0.265	30	06/03/11	06/16/11
Protactinium 234	-0.0169	U	0.0944		0.076	30	06/03/11	06/16/11
Radium (226)	0.369	J	0.111	0.700	0.045	30	06/03/11	06/16/11
Thallium 208	0.148		0.0500		0.018	30	06/03/11	06/16/11
Thorium 232	0.237		0.153		0.086	30	06/03/11	06/16/11
Thorium 234	0.0	U	0.858		0.707	30	06/03/11	06/16/11
Uranium 235	0.0383	U	0.164		0.132	30	06/03/11	06/16/11

NOTE(S)

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 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 Kev line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-001 DUP

Radiochemistry

Lab Sample ID: F1F020455-001X
 Work Order: MJOCQ
 Matrix: SOLID

Date Collected: 05/13/11 1000
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.434		0.168		0.115	30	06/03/11	06/16/11
Americium 241	0.00207	U	0.0948		0.077	30	06/03/11	06/16/11
Bismuth 212	0.142	U	0.317		0.250	30	06/03/11	06/16/11
Bismuth 214	0.413		0.124		0.051	30	06/03/11	06/16/11
Cesium 137	0.000253	U	0.0384	0.0700	0.031	30	06/03/11	06/16/11
Cobalt 60	-0.0166	U	0.0524		0.040	30	06/03/11	06/16/11
Europium 152	-0.00746	U	0.0989		0.080	30	06/03/11	06/16/11
Europium 154	-0.0568	U	0.348		0.278	30	06/03/11	06/16/11
Lead 210	1.36	J	1.75	1.50	1.17	30	06/03/11	06/16/11
Lead 212	0.316		0.128		0.072	30	06/03/11	06/16/11
Lead 214	0.371		0.103		0.048	30	06/03/11	06/16/11
Potassium 40	9.69		1.57		0.305	30	06/03/11	06/16/11
Protactinium 234	-0.0515	U	0.116		0.091	30	06/03/11	06/16/11
Radium (226)	0.413	J	0.124	0.700	0.051	30	06/03/11	06/16/11
Thallium 208	0.104		0.0519		0.030	30	06/03/11	06/16/11
Thorium 232	0.434		0.168		0.115	30	06/03/11	06/16/11
Thorium 234	0.131	U	0.903		0.783	30	06/03/11	06/16/11
Uranium 235	0.0684	U	0.154		0.124	30	06/03/11	06/16/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-002

Radiochemistry

Lab Sample ID: F1F020455-002
 Work Order: MJOCR
 Matrix: SOLID

Date Collected: 05/13/11 1005
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.209		0.233		0.152	30	06/03/11	06/12/11
Americium 241	0.0134	U	0.114		0.094	30	06/03/11	06/12/11
Bismuth 212	0.0544	U	0.472		0.380	30	06/03/11	06/12/11
Bismuth 214	0.297		0.143		0.067	30	06/03/11	06/12/11
Cesium 137	0.0179	U	0.0634	0.0700	0.054	30	06/03/11	06/12/11
Cobalt 60	-0.0230	U	0.918		0.034	30	06/03/11	06/12/11
Europium 152	0.0394	U	0.0878		0.063	30	06/03/11	06/12/11
Europium 154	0.175	U	0.560		0.432	30	06/03/11	06/12/11
Lead 210	-1.06	U	42.3	1.50	1.24	30	06/03/11	06/12/11
Lead 212	0.286		0.127		0.061	30	06/03/11	06/12/11
Lead 214	0.429		0.124		0.046	30	06/03/11	06/12/11
Potassium 40	6.70		1.76		0.469	30	06/03/11	06/12/11
Protactinium 234	-0.0353	U	0.121		0.095	30	06/03/11	06/12/11
Radium (226)	0.297	J	0.143	0.700	0.067	30	06/03/11	06/12/11
Thallium 208	0.0540		0.0528		0.035	30	06/03/11	06/12/11
Thorium 232	0.209		0.233		0.152	30	06/03/11	06/12/11
Thorium 234	0.0286	U	0.949		0.839	30	06/03/11	06/12/11
Uranium 235	0.125	U	0.205		0.154	30	06/03/11	06/12/11

NOTE(S)

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J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-003

Radiochemistry

Lab Sample ID: F1F020455-003
 Work Order: MJOCT
 Matrix: SOLID

Date Collected: 05/13/11 1010
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.262		0.191		0.126	30	06/03/11	06/12/11
Americium 241	0.0253	U	0.0843		0.067	30	06/03/11	06/12/11
Bismuth 212	0.0947	U	0.291		0.226	30	06/03/11	06/12/11
Bismuth 214	0.319		0.107		0.049	30	06/03/11	06/12/11
Cesium 137	0.0115	U	0.0340	0.0700	0.026	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0538		0.044	30	06/03/11	06/12/11
Europium 152	-0.0243	U	0.106		0.084	30	06/03/11	06/12/11
Europium 154	-0.0459	U	0.276		0.219	30	06/03/11	06/12/11
Lead 210	0.741	J	0.911	1.50	0.679	30	06/03/11	06/12/11
Lead 212	0.267		0.0896		0.044	30	06/03/11	06/12/11
Lead 214	0.477		0.112		0.056	30	06/03/11	06/12/11
Potassium 40	10.2		1.56		0.263	30	06/03/11	06/12/11
Protactinium 234	0.0459	U	0.117		0.092	30	06/03/11	06/12/11
Radium (226)	0.319	J	0.107	0.700	0.049	30	06/03/11	06/12/11
Thallium 208	0.183		0.0500		0.013	30	06/03/11	06/12/11
Thorium 232	0.262		0.191		0.126	30	06/03/11	06/12/11
Thorium 234	0.114	U	0.629		0.508	30	06/03/11	06/12/11
Uranium 235	0.0814	U	0.184		0.144	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-004

Radiochemistry

Lab Sample ID: F1F020455-004
 Work Order: MJOCW
 Matrix: SOLID

Date Collected: 05/13/11 1015
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.445		0.145		0.060	30	06/03/11	06/12/11
Americium 241	-0.0262	U	0.104		0.083	30	06/03/11	06/12/11
Bismuth 212	-0.0662	U	2.65		0.215	30	06/03/11	06/12/11
Bismuth 214	0.295		0.125		0.061	30	06/03/11	06/12/11
Cesium 137	-0.00750	U	0.0399	0.0700	0.031	30	06/03/11	06/12/11
Cobalt 60	-0.00605	U	0.0388		0.030	30	06/03/11	06/12/11
Europium 152	-0.00315	U	0.106		0.086	30	06/03/11	06/12/11
Europium 154	-0.0979	U	0.345		0.268	30	06/03/11	06/12/11
Lead 210	1.30	J	1.59	1.50	1.10	30	06/03/11	06/12/11
Lead 212	0.332		0.111		0.062	30	06/03/11	06/12/11
Lead 214	0.292		0.111		0.056	30	06/03/11	06/12/11
Potassium 40	8.42		1.55		0.497	30	06/03/11	06/12/11
Protactinium 234	0.0494	U	0.124		0.098	30	06/03/11	06/12/11
Radium (226)	0.295	J	0.125	0.700	0.061	30	06/03/11	06/12/11
Thallium 208	0.141		0.0568		0.029	30	06/03/11	06/12/11
Thorium 232	0.445		0.145		0.060	30	06/03/11	06/12/11
Thorium 234	0.151	U	0.898		0.780	30	06/03/11	06/12/11
Uranium 235	-0.0478	U	8.09		0.180	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-005

Radiochemistry

Lab Sample ID: F1F020455-005
 Work Order: MJOCX
 Matrix: SOLID

Date Collected: 05/13/11 1020
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.239		0.0986		0.120	30	06/03/11	06/12/11
Americium 241	0.0284	U	0.0703		0.055	30	06/03/11	06/12/11
Bismuth 212	0.108	U	0.301		0.233	30	06/03/11	06/12/11
Bismuth 214	0.376		0.124		0.052	30	06/03/11	06/12/11
Cesium 137	0.0	U	0.0342	0.0700	0.028	30	06/03/11	06/12/11
Cobalt 60	0.00250	U	0.0496		0.040	30	06/03/11	06/12/11
Europium 152	-0.0214	U	0.0884		0.070	30	06/03/11	06/12/11
Europium 154	-0.00701	U	0.299		0.245	30	06/03/11	06/12/11
Lead 210	-0.0190	U	0.858	1.50	0.705	30	06/03/11	06/12/11
Lead 212	0.374		0.114		0.053	30	06/03/11	06/12/11
Lead 214	0.394		0.113		0.047	30	06/03/11	06/12/11
Potassium 40	9.15		1.44		0.227	30	06/03/11	06/12/11
Protactinium 234	-0.00639	U	0.108		0.088	30	06/03/11	06/12/11
Radium (226)	0.376	J	0.124	0.700	0.052	30	06/03/11	06/12/11
Thallium 208	0.0850		0.0427		0.024	30	06/03/11	06/12/11
Thorium 232	0.239		0.0986		0.120	30	06/03/11	06/12/11
Thorium 234	0.0954	U	0.984		0.805	30	06/03/11	06/12/11
Uranium 235	-0.00760	U	0.158		0.129	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-006

Radiochemistry

Lab Sample ID: F1F020455-006
 Work Order: MJ0C0
 Matrix: SOLID

Date Collected: 05/13/11 1025
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.182		0.225		0.174	30	06/03/11	06/12/11
Americium 241	-0.0399	U	0.107		0.085	30	06/03/11	06/12/11
Bismuth 212	0.227	U	0.390		0.290	30	06/03/11	06/12/11
Bismuth 214	0.392		0.153		0.071	30	06/03/11	06/12/11
Cesium 137	-0.00523	U	0.0503	0.0700	0.040	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0583		0.048	30	06/03/11	06/12/11
Europium 152	-0.0400	U	0.122		0.096	30	06/03/11	06/12/11
Europium 154	0.00713	U	0.325		0.266	30	06/03/11	06/12/11
Lead 210	-0.0872	U	1.48	1.50	1.16	30	06/03/11	06/12/11
Lead 212	0.306		0.105		0.056	30	06/03/11	06/12/11
Lead 214	0.571		0.146		0.057	30	06/03/11	06/12/11
Potassium 40	9.10		1.57		0.468	30	06/03/11	06/12/11
Protactinium 234	-0.00896	U	0.176		0.144	30	06/03/11	06/12/11
Radium (226)	0.392	J	0.153	0.700	0.071	30	06/03/11	06/12/11
Thallium 208	0.161		0.0575		0.026	30	06/03/11	06/12/11
Thorium 232	0.182		0.225		0.174	30	06/03/11	06/12/11
Thorium 234	0.553	U	1.08		0.806	30	06/03/11	06/12/11
Uranium 235	0.0297	U	0.227		0.189	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-007

Radiochemistry

Lab Sample ID: F1F020455-007
 Work Order: MJ0C1
 Matrix: SOLID

Date Collected: 05/13/11 1030
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1154137	Yld %	
Actinium 228	0.204		0.195		0.132	30	06/03/11	06/12/11
Americium 241	0.0539	U	0.0952		0.074	30	06/03/11	06/12/11
Bismuth 212	0.148	U	0.333		0.250	30	06/03/11	06/12/11
Bismuth 214	0.318		0.125		0.063	30	06/03/11	06/12/11
Cesium 137	-0.00258	U	0.0513	0.0700	0.041	30	06/03/11	06/12/11
Cobalt 60	-0.0148	U	0.0676		0.053	30	06/03/11	06/12/11
Europium 152	0.00257	U	0.110		0.090	30	06/03/11	06/12/11
Europium 154	0.0	U	0.258		0.213	30	06/03/11	06/12/11
Lead 210	0.172	U	1.13	1.50	1.01	30	06/03/11	06/12/11
Lead 212	0.378		0.102		0.050	30	06/03/11	06/12/11
Lead 214	0.282		0.115		0.059	30	06/03/11	06/12/11
Potassium 40	7.28		1.51		0.537	30	06/03/11	06/12/11
Protactinium 234	0.0352	U	0.129		0.103	30	06/03/11	06/12/11
Radium (226)	0.318	J	0.125	0.700	0.063	30	06/03/11	06/12/11
Thallium 208	0.226		0.0631		0.023	30	06/03/11	06/12/11
Thorium 232	0.204		0.195		0.132	30	06/03/11	06/12/11
Thorium 234	0.776	U	1.02		0.833	30	06/03/11	06/12/11
Uranium 235	0.0704	U	0.246		0.201	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-008

Radiochemistry

Lab Sample ID: F1F020455-008
 Work Order: MJOC2
 Matrix: SOLID

Date Collected: 05/13/11 1035
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.220		0.257		0.175	30	06/03/11	06/12/11
Americium 241	-0.0197	U	4.62		0.087	30	06/03/11	06/12/11
Bismuth 212	0.0790	U	0.457		0.362	30	06/03/11	06/12/11
Bismuth 214	0.554		0.162		0.050	30	06/03/11	06/12/11
Cesium 137	-0.0301	U	1.21	0.0700	0.061	30	06/03/11	06/12/11
Cobalt 60	-0.0225	U	0.901		0.034	30	06/03/11	06/12/11
Europium 152	0.0379	U	0.122		0.094	30	06/03/11	06/12/11
Europium 154	0.0	U	0.444		0.366	30	06/03/11	06/12/11
Lead 210	0.447	U	1.14	1.50	0.995	30	06/03/11	06/12/11
Lead 212	0.452		0.131		0.050	30	06/03/11	06/12/11
Lead 214	0.464		0.164		0.072	30	06/03/11	06/12/11
Potassium 40	8.25		1.84		0.224	30	06/03/11	06/12/11
Protactinium 234	-0.00122	U	0.131		0.108	30	06/03/11	06/12/11
Radium (226)	0.554	J	0.162	0.700	0.050	30	06/03/11	06/12/11
Thallium 208	0.105		0.0779		0.051	30	06/03/11	06/12/11
Thorium 232	0.220		0.257		0.175	30	06/03/11	06/12/11
Thorium 234	-0.683	U	27.3		1.03	30	06/03/11	06/12/11
Uranium 235	0.0847	U	0.196		0.151	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-009

Radiochemistry

Lab Sample ID: F1F020455-009
 Work Order: MJ0C3
 Matrix: SOLID

Date Collected: 05/13/11 1040
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.282		0.274		0.186	30	06/03/11	06/12/11
Americium 241	-0.0549	U	0.120		0.095	30	06/03/11	06/12/11
Bismuth 212	0.315		0.391		0.258	30	06/03/11	06/12/11
Bismuth 214	0.473		0.170		0.082	30	06/03/11	06/12/11
Cesium 137	0.0263	U	0.0612	0.0700	0.046	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0165		0.019	30	06/03/11	06/12/11
Europium 152	0.0169	U	0.142		0.115	30	06/03/11	06/12/11
Europium 154	0.0134	U	0.410		0.336	30	06/03/11	06/12/11
Lead 210	1.06	J	1.33	1.50	1.00	30	06/03/11	06/12/11
Lead 212	0.308		0.146		0.075	30	06/03/11	06/12/11
Lead 214	0.719		0.146		0.068	30	06/03/11	06/12/11
Potassium 40	7.33		1.78		0.645	30	06/03/11	06/12/11
Protactinium 234	-0.00850	U	0.162		0.132	30	06/03/11	06/12/11
Radium (226)	0.473	J	0.170	0.700	0.082	30	06/03/11	06/12/11
Thallium 208	0.0369	U	0.0652		0.050	30	06/03/11	06/12/11
Thorium 232	0.282		0.274		0.186	30	06/03/11	06/12/11
Thorium 234	0.325	U	1.06		0.917	30	06/03/11	06/12/11
Uranium 235	0.149	U	0.277		0.222	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-010

Radiochemistry

Lab Sample ID: F1F020455-010
 Work Order: MJ0C5
 Matrix: SOLID

Date Collected: 05/13/11 1045
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.525		0.147		0.053	30	06/03/11	06/12/11
Americium 241	0.0434	U	0.0888		0.069	30	06/03/11	06/12/11
Bismuth 212	0.299		0.338		0.236	30	06/03/11	06/12/11
Bismuth 214	0.406		0.126		0.050	30	06/03/11	06/12/11
Cesium 137	0.00454	U	0.0275	0.0700	0.021	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0102		0.011	30	06/03/11	06/12/11
Europium 152	0.0281	U	0.0895		0.070	30	06/03/11	06/12/11
Europium 154	0.0	U	0.254		0.209	30	06/03/11	06/12/11
Lead 210	0.858	U	1.23	1.50	0.954	30	06/03/11	06/12/11
Lead 212	0.338		0.115		0.054	30	06/03/11	06/12/11
Lead 214	0.506		0.104		0.049	30	06/03/11	06/12/11
Potassium 40	8.08		1.44		0.405	30	06/03/11	06/12/11
Protactinium 234	0.00842	U	0.113		0.092	30	06/03/11	06/12/11
Radium (226)	0.406	J	0.126	0.700	0.050	30	06/03/11	06/12/11
Thallium 208	0.0683		0.0544		0.038	30	06/03/11	06/12/11
Thorium 232	0.525		0.147		0.053	30	06/03/11	06/12/11
Thorium 234	0.741		0.932		0.720	30	06/03/11	06/12/11
Uranium 235	-0.0165	U	0.208		0.170	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-011

Radiochemistry

Lab Sample ID: F1F020455-011
 Work Order: MJ0C6
 Matrix: SOLID

Date Collected: 05/13/11 1050
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137		Yld %
Actinium 228	0.170		0.0931		0.154	30	06/03/11	06/12/11
Americium 241	-0.0248	U	0.0962		0.077	30	06/03/11	06/12/11
Bismuth 212	0.250		0.319		0.232	30	06/03/11	06/12/11
Bismuth 214	0.409		0.115		0.045	30	06/03/11	06/12/11
Cesium 137	-0.00515	U	0.0461	0.0700	0.037	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0113		0.013	30	06/03/11	06/12/11
Europium 152	0.0324	U	0.0779		0.058	30	06/03/11	06/12/11
Europium 154	-0.0925	U	0.302		0.231	30	06/03/11	06/12/11
Lead 210	0.363	U	1.40	1.50	1.26	30	06/03/11	06/12/11
Lead 212	0.319		0.0964		0.056	30	06/03/11	06/12/11
Lead 214	0.538		0.136		0.059	30	06/03/11	06/12/11
Potassium 40	6.84		1.42		0.499	30	06/03/11	06/12/11
Protactinium 234	0.0962		0.104		0.075	30	06/03/11	06/12/11
Radium (226)	0.409	J	0.115	0.700	0.045	30	06/03/11	06/12/11
Thallium 208	0.0702		0.0518		0.038	30	06/03/11	06/12/11
Thorium 232	0.170		0.0931		0.154	30	06/03/11	06/12/11
Thorium 234	0.273	U	0.964		0.827	30	06/03/11	06/12/11
Uranium 235	0.00659	U	0.169		0.144	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-012

Radiochemistry

Lab Sample ID: F1F020455-012
 Work Order: MJOC8
 Matrix: SOLID

Date Collected: 05/13/11 1055
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.181		0.143		0.086	30	06/03/11	06/12/11
Americium 241	0.0539	U	0.0857		0.066	30	06/03/11	06/12/11
Bismuth 212	0.0936	U	0.314		0.245	30	06/03/11	06/12/11
Bismuth 214	0.461		0.130		0.048	30	06/03/11	06/12/11
Cesium 137	0.00546	U	0.0404	0.0700	0.032	30	06/03/11	06/12/11
Cobalt 60	0.0137	U	0.0565		0.044	30	06/03/11	06/12/11
Europium 152	-0.0326	U	0.117		0.093	30	06/03/11	06/12/11
Europium 154	0.0197	U	0.333		0.272	30	06/03/11	06/12/11
Lead 210	-0.639	U	1.15	1.50	0.898	30	06/03/11	06/12/11
Lead 212	0.335		0.121		0.053	30	06/03/11	06/12/11
Lead 214	0.366		0.102		0.063	30	06/03/11	06/12/11
Potassium 40	9.59		1.52		0.240	30	06/03/11	06/12/11
Protactinium 234	0.0173	U	0.139		0.113	30	06/03/11	06/12/11
Radium (226)	0.461	J	0.130	0.700	0.048	30	06/03/11	06/12/11
Thallium 208	0.0671		0.0473		0.032	30	06/03/11	06/12/11
Thorium 232	0.181		0.143		0.086	30	06/03/11	06/12/11
Thorium 234	0.350	U	0.894		0.713	30	06/03/11	06/12/11
Uranium 235	0.0983	U	0.178		0.137	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-013

Radiochemistry

Lab Sample ID: F1F020455-013
 Work Order: MJ0C9
 Matrix: SOLID

Date Collected: 05/13/11 1100
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1154137	Yld %	
Aotinium 228	0.230		0.197		0.143	30	06/03/11	06/12/11
Americium 241	0.0679	U	0.101		0.078	30	06/03/11	06/12/11
Bismuth 212	0.200	U	0.397		0.300	30	06/03/11	06/12/11
Bismuth 214	0.279		0.126		0.081	30	06/03/11	06/12/11
Cesium 137	-0.000679	U	0.0514	0.0700	0.042	30	06/03/11	06/12/11
Cobalt 60	0.00676	U	0.0530		0.042	30	06/03/11	06/12/11
Europium 152	0.0446	U	0.118		0.092	30	06/03/11	06/12/11
Europium 154	0.0	U	0.0675		0.078	30	06/03/11	06/12/11
Lead 210	0.173	U	1.48	1.50	1.29	30	06/03/11	06/12/11
Lead 212	0.318		0.103		0.056	30	06/03/11	06/12/11
Lead 214	0.480		0.134		0.066	30	06/03/11	06/12/11
Potassium 40	10.6		1.70		0.473	30	06/03/11	06/12/11
Protactinium 234	0.0	U	0.143		0.118	30	06/03/11	06/12/11
Radium (226)	0.279	J	0.126	0.700	0.081	30	06/03/11	06/12/11
Thallium 208	0.0385	U	0.0576		0.046	30	06/03/11	06/12/11
Thorium 232	0.230		0.197		0.143	30	06/03/11	06/12/11
Thorium 234	0.992		1.17		0.831	30	06/03/11	06/12/11
Uranium 235	-0.0247	U	0.676		0.179	30	06/03/11	06/12/11

NOTE(S)

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 U Result is less than the sample detection limit.

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Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-014

Radiochemistry

Lab Sample ID: F1F020455-014
 Work Order: MJ0DA
 Matrix: SOLID

Date Collected: 05/13/11 1105
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Aotinium 228	0.259		0.186		0.113	30	06/03/11	06/12/11
Americium 241	-0.000487	U	0.0984		0.081	30	06/03/11	06/12/11
Bismuth 212	0.230	U	0.342		0.244	30	06/03/11	06/12/11
Bismuth 214	0.332		0.130		0.064	30	06/03/11	06/12/11
Cesium 137	0.0343	U	0.0540	0.0700	0.040	30	06/03/11	06/12/11
Cobalt 60	0.0116	U	0.0526		0.041	30	06/03/11	06/12/11
Europium 152	-0.0325	U	0.124		0.098	30	06/03/11	06/12/11
Europium 154	0.0189	U	0.355		0.289	30	06/03/11	06/12/11
Lead 210	-0.233	U	1.63	1.50	0.993	30	06/03/11	06/12/11
Lead 212	0.182		0.0945		0.067	30	06/03/11	06/12/11
Lead 214	0.419		0.115		0.070	30	06/03/11	06/12/11
Potassium 40	10.3		1.70		0.346	30	06/03/11	06/12/11
Protactinium 234	0.0294	U	0.111		0.088	30	06/03/11	06/12/11
Radium (226)	0.332	J	0.130	0.700	0.064	30	06/03/11	06/12/11
Thallium 208	0.0705		0.0548		0.039	30	06/03/11	06/12/11
Thorium 232	0.259		0.186		0.113	30	06/03/11	06/12/11
Thorium 234	0.457	U	0.917		0.766	30	06/03/11	06/12/11
Uranium 235	0.0121	U	0.196		0.165	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-015

Radiochemistry

Lab Sample ID: F1F020455-015
 Work Order: MJODC
 Matrix: SOLID

Date Collected: 05/13/11 1110
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.199		0.208		0.127	30	06/03/11	06/12/11
Americium 241	-0.0216	U	0.863		0.112	30	06/03/11	06/12/11
Bismuth 212	0.306		0.441		0.301	30	06/03/11	06/12/11
Bismuth 214	0.290		0.137		0.065	30	06/03/11	06/12/11
Cesium 137	0.00302	U	0.0702	0.0700	0.061	30	06/03/11	06/12/11
Cobalt 60	-0.0236	U	0.942		0.035	30	06/03/11	06/12/11
Europium 152	0.0	U	0.151		0.125	30	06/03/11	06/12/11
Europium 154	-0.0362	U	0.580		0.472	30	06/03/11	06/12/11
Lead 210	0.611	U	1.34	1.50	1.15	30	06/03/11	06/12/11
Lead 212	0.380		0.125		0.056	30	06/03/11	06/12/11
Lead 214	0.505		0.151		0.093	30	06/03/11	06/12/11
Potassium 40	10.1		2.10		0.234	30	06/03/11	06/12/11
Protactinium 234	-0.00257	U	0.110		0.090	30	06/03/11	06/12/11
Radium (226)	0.290	J	0.137	0.700	0.065	30	06/03/11	06/12/11
Thallium 208	0.0456		0.0610		0.044	30	06/03/11	06/12/11
Thorium 232	0.199		0.208		0.127	30	06/03/11	06/12/11
Thorium 234	1.03		1.15		0.921	30	06/03/11	06/12/11
Uranium 235	-0.000744	U	0.205		0.168	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-016

Radiochemistry

Lab Sample ID: F1F020455-016
 Work Order: MJ0DD
 Matrix: SOLID

Date Collected: 05/13/11 1115
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137		Yld %
Actinium 228	0.186		0.241		0.171	30	06/03/11	06/12/11
Americium 241	-0.0349	U	0.106		0.084	30	06/03/11	06/12/11
Bismuth 212	0.247	U	0.428		0.310	30	06/03/11	06/12/11
Bismuth 214	0.605		0.154		0.021	30	06/03/11	06/12/11
Cesium 137	0.0167	U	0.0585	0.0700	0.045	30	06/03/11	06/12/11
Cobalt 60	-0.00689	U	0.0588		0.046	30	06/03/11	06/12/11
Europium 152	-0.0280	U	0.145		0.116	30	06/03/11	06/12/11
Europium 154	0.00245	U	0.374		0.308	30	06/03/11	06/12/11
Lead 210	-0.236	U	1.33	1.50	1.07	30	06/03/11	06/12/11
Lead 212	0.344		0.108		0.052	30	06/03/11	06/12/11
Lead 214	0.627		0.151		0.041	30	06/03/11	06/12/11
Potassium 40	10.1		1.92		0.323	30	06/03/11	06/12/11
Protactinium 234	0.0369	U	0.118		0.093	30	06/03/11	06/12/11
Radium (226)	0.605	J	0.154	0.700	0.021	30	06/03/11	06/12/11
Thallium 208	0.0361	U	0.0667		0.052	30	06/03/11	06/12/11
Thorium 232	0.186		0.241		0.171	30	06/03/11	06/12/11
Thorium 234	0.454	U	1.01		0.868	30	06/03/11	06/12/11
Uranium 235	0.0985	U	0.262		0.213	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-017

Radiochemistry

Lab Sample ID: F1F020455-017
 Work Order: MJODE
 Matrix: SOLID

Date Collected: 05/13/11 1120
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.517		0.170		0.031	30	06/03/11	06/12/11
Americium 241	0.0451	U	0.0853		0.066	30	06/03/11	06/12/11
Bismuth 212	0.126	U	0.379		0.296	30	06/03/11	06/12/11
Bismuth 214	0.462		0.147		0.060	30	06/03/11	06/12/11
Cesium 137	-0.00491	U	0.0422	0.0700	0.034	30	06/03/11	06/12/11
Cobalt 60	0.0	U	0.0107		0.012	30	06/03/11	06/12/11
Europium 152	-0.0268	U	0.125		0.100	30	06/03/11	06/12/11
Europium 154	0.00484	U	0.338		0.278	30	06/03/11	06/12/11
Lead 210	1.17	J	0.948	1.50	0.658	30	06/03/11	06/12/11
Lead 212	0.476		0.110		0.042	30	06/03/11	06/12/11
Lead 214	0.486		0.122		0.047	30	06/03/11	06/12/11
Potassium 40	9.83		1.58		0.286	30	06/03/11	06/12/11
Protactinium 234	-0.0569	U	0.144		0.114	30	06/03/11	06/12/11
Radium (226)	0.462	J	0.147	0.700	0.060	30	06/03/11	06/12/11
Thallium 208	0.0800		0.0518		0.034	30	06/03/11	06/12/11
Thorium 232	0.517		0.170		0.031	30	06/03/11	06/12/11
Thorium 234	2.07		0.973		0.480	30	06/03/11	06/12/11
Uranium 235	0.0665	U	0.156		0.121	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-018

Radiochemistry

Lab Sample ID: F1F020455-018
 Work Order: MJ0DG
 Matrix: SOLID

Date Collected: 05/13/11 1125
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.459		0.171		0.059	30	06/03/11	06/12/11
Americium 241	-0.00542	U	0.109		0.089	30	06/03/11	06/12/11
Bismuth 212	0.0180	U	0.385		0.323	30	06/03/11	06/12/11
Bismuth 214	0.347		0.132		0.079	30	06/03/11	06/12/11
Cesium 137	0.0111	U	0.0449	0.0700	0.035	30	06/03/11	06/12/11
Cobalt 60	0.000504	U	0.0432		0.035	30	06/03/11	06/12/11
Europium 152	0.000375	U	0.101		0.083	30	06/03/11	06/12/11
Europium 154	0.0855	U	0.301		0.232	30	06/03/11	06/12/11
Lead 210	-0.00699	U	1.34	1.50	1.23	30	06/03/11	06/12/11
Lead 212	0.260		0.113		0.064	30	06/03/11	06/12/11
Lead 214	0.413		0.112		0.063	30	06/03/11	06/12/11
Potassium 40	8.40		1.55		0.524	30	06/03/11	06/12/11
Protactinium 234	0.00126	U	0.124		0.102	30	06/03/11	06/12/11
Radium (226)	0.347	J	0.132	0.700	0.079	30	06/03/11	06/12/11
Thallium 208	0.0787		0.0621		0.046	30	06/03/11	06/12/11
Thorium 232	0.459		0.171		0.059	30	06/03/11	06/12/11
Thorium 234	0.304	U	0.995		0.846	30	06/03/11	06/12/11
Uranium 235	0.0779	U	0.213		0.173	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-019

Radiochemistry

Lab Sample ID: F1F020455-019
 Work Order: MJODH
 Matrix: SOLID

Date Collected: 05/13/11 1130
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1154137		Yld %	
Actinium 228	0.327		0.146		0.090	30	06/03/11	06/12/11
Americium 241	0.0	U	0.0995		0.081	30	06/03/11	06/12/11
Bismuth 212	0.193	U	0.311		0.228	30	06/03/11	06/12/11
Bismuth 214	0.453		0.111		0.036	30	06/03/11	06/12/11
Cesium 137	-0.00443	U	0.0430	0.0700	0.034	30	06/03/11	06/12/11
Cobalt 60	0.000397	U	0.0376		0.030	30	06/03/11	06/12/11
Europium 152	0.0152	U	0.0886		0.071	30	06/03/11	06/12/11
Europium 154	-0.210	U	0.417		0.318	30	06/03/11	06/12/11
Lead 210	-0.290	U	0.946	1.50	0.755	30	06/03/11	06/12/11
Lead 212	0.300		0.102		0.048	30	06/03/11	06/12/11
Lead 214	0.362		0.127		0.069	30	06/03/11	06/12/11
Potassium 40	10.1		1.54		0.233	30	06/03/11	06/12/11
Protactinium 234	-0.0788	U	0.146		0.116	30	06/03/11	06/12/11
Radium (226)	0.453	J	0.111	0.700	0.036	30	06/03/11	06/12/11
Thallium 208	0.0618		0.0475		0.033	30	06/03/11	06/12/11
Thorium 232	0.327		0.146		0.090	30	06/03/11	06/12/11
Thorium 234	0.0217	U	0.645		0.530	30	06/03/11	06/12/11
Uranium 235	0.0156	U	0.199		0.163	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.

Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1F020455

Tetra Tech EC, Inc.

Client Sample ID: 04A-DIA-020

Radiochemistry

Lab Sample ID: F1F020455-020
 Work Order: MJODJ
 Matrix: SOLID

Date Collected: 05/13/11 1135
 Date Received: 06/02/11 1305

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1154137	Yld %	
Actinium 228	0.515		0.175		0.084	30	06/03/11	06/12/11
Americium 241	-0.000444	U	0.104		0.085	30	06/03/11	06/12/11
Bismuth 212	0.158	U	0.384		0.294	30	06/03/11	06/12/11
Bismuth 214	0.486		0.160		0.071	30	06/03/11	06/12/11
Cesium 137	-0.00280	U	0.0571	0.0700	0.046	30	06/03/11	06/12/11
Cobalt 60	-0.0181	U	0.0699		0.055	30	06/03/11	06/12/11
Europium 152	-0.00529	U	0.123		0.101	30	06/03/11	06/12/11
Europium 154	-0.129	U	0.430		0.336	30	06/03/11	06/12/11
Lead 210	0.135	U	1.41	1.50	1.24	30	06/03/11	06/12/11
Lead 212	0.327		0.108		0.060	30	06/03/11	06/12/11
Lead 214	0.536		0.139		0.072	30	06/03/11	06/12/11
Potassium 40	11.3		1.79		0.486	30	06/03/11	06/12/11
Protactinium 234	-0.0682	U	0.178		0.142	30	06/03/11	06/12/11
Radium (226)	0.486	J	0.160	0.700	0.071	30	06/03/11	06/12/11
Thallium 208	0.0619		0.0678		0.052	30	06/03/11	06/12/11
Thorium 232	0.515		0.175		0.084	30	06/03/11	06/12/11
Thorium 234	-0.319	U	1.60		0.935	30	06/03/11	06/12/11
Uranium 235	0.168	U	0.224		0.174	30	06/03/11	06/12/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1F020455

ATTACHMENT 2
REFERENCE AREA
SAMPLE RESULTS

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Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-001

Radiochemistry

Lab Sample ID: F1E160460-001
 Work Order: MJG4M
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.377		0.262		0.158	30	05/17/11	05/28/11
Americium 241	0.0283	U	0.0885		0.070	30	05/17/11	05/28/11
Bismuth 212	0.178	U	0.537		0.418	30	05/17/11	05/28/11
Bismuth 214	0.827		0.186		0.040	30	05/17/11	05/28/11
Cesium 137	0.0210	U	0.0376	0.0700	0.025	30	05/17/11	05/28/11
Cobalt 60	0.0	U	0.0167		0.019	30	05/17/11	05/28/11
Europium 152	-0.0375	U	0.134		0.106	30	05/17/11	05/28/11
Europium 154	0.0471	U	0.352		0.280	30	05/17/11	05/28/11
Lead 210	0.677	U	1.36	1.50	1.15	30	05/17/11	05/28/11
Lead 212	0.482		0.128		0.060	30	05/17/11	05/28/11
Lead 214	0.793		0.170		0.056	30	05/17/11	05/28/11
Potassium 40	10.3		1.98		0.314	30	05/17/11	05/28/11
Protactinium 234	-0.0381	U	0.145		0.116	30	05/17/11	05/28/11
Radium (226)	0.827		0.186	0.700	0.040	30	05/17/11	05/28/11
Thallium 208	0.267		0.0763		0.021	30	05/17/11	05/28/11
Thorium 232	0.377		0.262		0.158	30	05/17/11	05/28/11
Thorium 234	0.394	U	0.994		0.825	30	05/17/11	05/28/11
Uranium 235	0.134	U	0.245		0.191	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 509.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-001 DUP

Radiochemistry

Lab Sample ID: F1E160460-001X
 Work Order: MJG4M
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1137259	Yld %	
Actinium 228	0.448		0.164		0.088	30	05/17/11	05/28/11
Americium 241	-0.0428	U	0.118		0.094	30	05/17/11	05/28/11
Bismuth 212	0.206	U	0.382		0.289	30	05/17/11	05/28/11
Bismuth 214	0.616		0.175		0.071	30	05/17/11	05/28/11
Cesium 137	-0.00494	U	0.0440	0.0700	0.035	30	05/17/11	05/28/11
Cobalt 60	0.00786	U	0.0474		0.037	30	05/17/11	05/28/11
Europium 152	0.0	U	0.145		0.120	30	05/17/11	05/28/11
Europium 154	-0.0188	U	0.360		0.294	30	05/17/11	05/28/11
Lead 210	-0.242	U	2.06	1.50	1.19	30	05/17/11	05/28/11
Lead 212	0.533		0.122		0.059	30	05/17/11	05/28/11
Lead 214	0.629		0.129		0.074	30	05/17/11	05/28/11
Potassium 40	10.2		1.57		0.403	30	05/17/11	05/28/11
Protactinium 234	0.0	U	0.168		0.139	30	05/17/11	05/28/11
Radium (226)	0.616	J	0.175	0.700	0.071	30	05/17/11	05/28/11
Thallium 208	0.228		0.0734		0.030	30	05/17/11	05/28/11
Thorium 232	0.448		0.164		0.088	30	05/17/11	05/28/11
Thorium 234	0.113	U	1.14		0.987	30	05/17/11	05/28/11
Uranium 235	0.0496	U	0.230		0.190	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-002

Radiochemistry

Lab Sample ID: F1E160460-002
 Work Order: MJG4N
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.351		0.250		0.149	30	05/17/11	05/28/11
Americium 241	-0.0272	U	1.89		0.088	30	05/17/11	05/28/11
Bismuth 212	0.0736	U	0.457		0.365	30	05/17/11	05/28/11
Bismuth 214	0.666		0.166		0.042	30	05/17/11	05/28/11
Cesium 137	-0.0116	U	0.146	0.0700	0.054	30	05/17/11	05/28/11
Cobalt 60	-0.0144	U	0.896		0.060	30	05/17/11	05/28/11
Europium 152	-0.0345	U	0.124		0.097	30	05/17/11	05/28/11
Europium 154	0.00458	U	0.345		0.283	30	05/17/11	05/28/11
Lead 210	0.219	U	1.14	1.50	0.990	30	05/17/11	05/28/11
Lead 212	0.470		0.136		0.061	30	05/17/11	05/28/11
Lead 214	0.755		0.183		0.065	30	05/17/11	05/28/11
Potassium 40	8.67		1.80		0.292	30	05/17/11	05/28/11
Protactinium 234	-0.0707	U	0.165		0.131	30	05/17/11	05/28/11
Radium (226)	0.666	J	0.166	0.700	0.042	30	05/17/11	05/28/11
Thallium 208	0.190		0.0632		0.015	30	05/17/11	05/28/11
Thorium 232	0.351		0.250		0.149	30	05/17/11	05/28/11
Thorium 234	-0.489	U	6.89		0.758	30	05/17/11	05/28/11
Uranium 235	0.0281	U	0.188		0.156	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-003

Radiochemistry

Lab Sample ID: F1E160460-003
 Work Order: MJG4P
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.443		0.156		0.168	30	05/17/11	05/28/11
Americium 241	0.0437	U	0.112		0.089	30	05/17/11	05/28/11
Bismuth 212	0.209	U	0.385		0.283	30	05/17/11	05/28/11
Bismuth 214	0.786		0.189		0.052	30	05/17/11	05/28/11
Cesium 137	0.0	U	0.0341	0.0700	0.028	30	05/17/11	05/28/11
Cobalt 60	0.0141	U	0.0542		0.041	30	05/17/11	05/28/11
Europium 152	0.0346	U	0.123		0.097	30	05/17/11	05/28/11
Europium 154	-0.124	U	0.450		0.352	30	05/17/11	05/28/11
Lead 210	1.01	U	1.37	1.50	1.06	30	05/17/11	05/28/11
Lead 212	0.675		0.134		0.046	30	05/17/11	05/28/11
Lead 214	0.852		0.172		0.047	30	05/17/11	05/28/11
Potassium 40	11.5		1.95		0.400	30	05/17/11	05/28/11
Protactinium 234	0.102	U	0.175		0.138	30	05/17/11	05/28/11
Radium (226)	0.786		0.189	0.700	0.052	30	05/17/11	05/28/11
Thallium 208	0.167		0.0697		0.038	30	05/17/11	05/28/11
Thorium 232	0.443		0.156		0.168	30	05/17/11	05/28/11
Thorium 234	-0.398	U	2.78		0.976	30	05/17/11	05/28/11
Uranium 235	0.00954	U	0.228		0.191	30	05/17/11	05/28/11

NOTE (S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-004

Radiochemistry

Lab Sample ID: F1E160460-004
 Work Order: MJG4Q
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.604		0.154		0.048	30	05/17/11	05/28/11
Americium 241	-0.0220	U	0.0921		0.074	30	05/17/11	05/28/11
Bismuth 212	0.132	U	0.329		0.254	30	05/17/11	05/28/11
Bismuth 214	0.548		0.142		0.050	30	05/17/11	05/28/11
Cesium 137	0.00157	U	0.0420	0.0700	0.034	30	05/17/11	05/28/11
Cobalt 60	-0.0110	U	0.0500		0.039	30	05/17/11	05/28/11
Europium 152	-0.00728	U	0.0934		0.076	30	05/17/11	05/28/11
Europium 154	-0.0703	U	0.313		0.248	30	05/17/11	05/28/11
Lead 210	0.711	J	0.844	1.50	0.627	30	05/17/11	05/28/11
Lead 212	0.472		0.107		0.045	30	05/17/11	05/28/11
Lead 214	0.598		0.138		0.049	30	05/17/11	05/28/11
Potassium 40	7.99		1.38		0.337	30	05/17/11	05/28/11
Protactinium 234	0.0117	U	0.131		0.107	30	05/17/11	05/28/11
Radium (226)	0.548	J	0.142	0.700	0.050	30	05/17/11	05/28/11
Thallium 208	0.107		0.0534		0.034	30	05/17/11	05/28/11
Thorium 232	0.604		0.154		0.048	30	05/17/11	05/28/11
Thorium 234	0.826		0.816		0.616	30	05/17/11	05/28/11
Uranium 235	0.0267	U	0.205		0.167	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-005

Radiochemistry

Lab Sample ID: F1E160460-005
 Work Order: MJG4R
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.391		0.168		0.109	30	05/17/11	05/28/11
Americium 241	-0.0366	U	0.121		0.098	30	05/17/11	05/28/11
Bismuth 212	0.278	U	0.409		0.313	30	05/17/11	05/28/11
Bismuth 214	0.878		0.184		0.061	30	05/17/11	05/28/11
Cesium 137	0.00482	U	0.0476	0.0700	0.038	30	05/17/11	05/28/11
Cobalt 60	0.0192	U	0.0347		0.023	30	05/17/11	05/28/11
Europium 152	0.0747	U	0.107		0.080	30	05/17/11	05/28/11
Europium 154	-0.00289	U	0.404		0.333	30	05/17/11	05/28/11
Lead 210	0.277	U	1.09	1.50	0.996	30	05/17/11	05/28/11
Lead 212	0.525		0.111		0.054	30	05/17/11	05/28/11
Lead 214	0.829		0.169		0.067	30	05/17/11	05/28/11
Potassium 40	9.41		1.48		0.299	30	05/17/11	05/28/11
Protactinium 234	0.00768	U	0.186		0.153	30	05/17/11	05/28/11
Radium (226)	0.878		0.184	0.700	0.061	30	05/17/11	05/28/11
Thallium 208	0.153		0.0552		0.027	30	05/17/11	05/28/11
Thorium 232	0.391		0.168		0.109	30	05/17/11	05/28/11
Thorium 234	0.703	U	1.05		0.860	30	05/17/11	05/28/11
Uranium 235	-0.0388	U	1.55		0.207	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-006

Radiochemistry

Lab Sample ID: F1E160460-006
 Work Order: MJG4T
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.835		0.171		0.026	30	05/17/11	05/28/11
Americium 241	0.0169	U	0.0942		0.076	30	05/17/11	05/28/11
Bismuth 212	0.131	U	0.335		0.260	30	05/17/11	05/28/11
Bismuth 214	0.447		0.161		0.072	30	05/17/11	05/28/11
Cesium 137	0.0132	U	0.0425	0.0700	0.033	30	05/17/11	05/28/11
Cobalt 60	0.0164	U	0.0390		0.028	30	05/17/11	05/28/11
Europium 152	-0.0172	U	0.0986		0.079	30	05/17/11	05/28/11
Europium 154	-0.0000374	U	0.297		0.244	30	05/17/11	05/28/11
Lead 210	0.372	U	0.954	1.50	0.758	30	05/17/11	05/28/11
Lead 212	0.534		0.121		0.050	30	05/17/11	05/28/11
Lead 214	0.756		0.138		0.039	30	05/17/11	05/28/11
Potassium 40	11.4		1.58		0.233	30	05/17/11	05/28/11
Protactinium 234	-0.0276	U	0.143		0.116	30	05/17/11	05/28/11
Radium (226)	0.447	J	0.161	0.700	0.072	30	05/17/11	05/28/11
Thallium 208	0.112		0.0502		0.030	30	05/17/11	05/28/11
Thorium 232	0.835		0.171		0.026	30	05/17/11	05/28/11
Thorium 234	0.707	U	0.919		0.716	30	05/17/11	05/28/11
Uranium 235	-0.0716	U	0.234		0.189	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-007

Radiochemistry

Lab Sample ID: F1E160460-007
 Work Order: MJG4W
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.599		0.183		0.087	30	05/17/11	05/28/11
Americium 241	-0.0324	U	0.114		0.092	30	05/17/11	05/28/11
Bismuth 212	0.235		0.320		0.228	30	05/17/11	05/28/11
Bismuth 214	0.459		0.120		0.048	30	05/17/11	05/28/11
Cesium 137	0.0198	U	0.0467	0.0700	0.035	30	05/17/11	05/28/11
Cobalt 60	0.0	U	0.0101		0.011	30	05/17/11	05/28/11
Europium 152	0.00227	U	0.0890		0.073	30	05/17/11	05/28/11
Europium 154	0.0848	U	0.307		0.239	30	05/17/11	05/28/11
Lead 210	0.254	U	1.11	1.50	0.964	30	05/17/11	05/28/11
Lead 212	0.521		0.122		0.058	30	05/17/11	05/28/11
Lead 214	0.496		0.122		0.053	30	05/17/11	05/28/11
Potassium 40	8.27		1.48		0.483	30	05/17/11	05/28/11
Protactinium 234	0.0000672	U	0.135		0.111	30	05/17/11	05/28/11
Radium (226)	0.459	J	0.120	0.700	0.048	30	05/17/11	05/28/11
Thallium 208	0.215		0.0579		0.019	30	05/17/11	05/28/11
Thorium 232	0.599		0.183		0.087	30	05/17/11	05/28/11
Thorium 234	0.714	U	1.07		0.875	30	05/17/11	05/28/11
Uranium 235	0.141	U	0.217		0.168	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-008

Radiochemistry

Lab Sample ID: F1E160460-008
 Work Order: MJG4X
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.314		0.188		0.080	30	05/17/11	05/28/11
Americium 241	-0.0205	U	0.104		0.083	30	05/17/11	05/28/11
Bismuth 212	0.139	U	0.259		0.173	30	05/17/11	05/28/11
Bismuth 214	0.626		0.183		0.059	30	05/17/11	05/28/11
Cesium 137	-0.00715	U	0.0468	0.0700	0.037	30	05/17/11	05/28/11
Cobalt 60	-0.000175	U	0.0551		0.045	30	05/17/11	05/28/11
Europium 152	0.0790	U	0.115		0.083	30	05/17/11	05/28/11
Europium 154	0.131	U	0.469		0.364	30	05/17/11	05/28/11
Lead 210	0.294	U	1.24	1.50	1.07	30	05/17/11	05/28/11
Lead 212	0.416		0.117		0.054	30	05/17/11	05/28/11
Lead 214	0.653		0.158		0.075	30	05/17/11	05/28/11
Potassium 40	8.99		1.92		0.598	30	05/17/11	05/28/11
Protactinium 234	0.0644	U	0.140		0.110	30	05/17/11	05/28/11
Radium (226)	0.626	J	0.183	0.700	0.059	30	05/17/11	05/28/11
Thallium 208	0.216		0.0679		0.020	30	05/17/11	05/28/11
Thorium 232	0.314		0.188		0.080	30	05/17/11	05/28/11
Thorium 234	0.357	U	1.01		0.842	30	05/17/11	05/28/11
Uranium 235	0.0962	U	0.274		0.219	30	05/17/11	05/28/11

NOTE(S)

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J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-009

Radiochemistry

Lab Sample ID: F1E160460-009
 Work Order: MJG40
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1137259		Yld %	
Actinium 228	0.484		0.179		0.048	30	05/17/11	05/28/11
Americium 241	0.0321	U	0.104		0.085	30	05/17/11	05/28/11
Bismuth 212	0.406		0.474		0.323	30	05/17/11	05/28/11
Bismuth 214	0.510		0.168		0.066	30	05/17/11	05/28/11
Cesium 137	-0.0280	U	64.4	0.0700	0.050	30	05/17/11	05/28/11
Cobalt 60	-0.0209	U	0.301		0.065	30	05/17/11	05/28/11
Europium 152	0.0	U	0.153		0.126	30	05/17/11	05/28/11
Europium 154	0.232		0.292		0.167	30	05/17/11	05/28/11
Lead 210	-0.940	U	28.6	1.50	1.06	30	05/17/11	05/28/11
Lead 212	0.553		0.129		0.049	30	05/17/11	05/28/11
Lead 214	0.690		0.137		0.049	30	05/17/11	05/28/11
Potassium 40	9.97		1.96		0.346	30	05/17/11	05/28/11
Protactinium 234	0.0422	U	0.129		0.102	30	05/17/11	05/28/11
Radium (226)	0.510	J	0.168	0.700	0.066	30	05/17/11	05/28/11
Thallium 208	0.181		0.0621		0.015	30	05/17/11	05/28/11
Thorium 232	0.484		0.179		0.048	30	05/17/11	05/28/11
Thorium 234	0.890		1.09		0.876	30	05/17/11	05/28/11
Uranium 235	-0.136	U	0.500		0.214	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-010

Radiochemistry

Lab Sample ID: F1E160460-010
 Work Order: MJG41
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.439		0.264		0.164	30	05/17/11	05/28/11
Americium 241	0.0606	U	0.108		0.085	30	05/17/11	05/28/11
Bismuth 212	0.207	U	0.468		0.360	30	05/17/11	05/28/11
Bismuth 214	0.839		0.170		0.030	30	05/17/11	05/28/11
Cesium 137	0.0122	U	0.0464	0.0700	0.036	30	05/17/11	05/28/11
Cobalt 60	-0.0214	U	0.0740		0.057	30	05/17/11	05/28/11
Europium 152	0.0267	U	0.129		0.103	30	05/17/11	05/28/11
Europium 154	0.0	U	0.421		0.347	30	05/17/11	05/28/11
Lead 210	1.29	J	1.38	1.50	1.05	30	05/17/11	05/28/11
Lead 212	0.495		0.143		0.067	30	05/17/11	05/28/11
Lead 214	0.824		0.144		0.064	30	05/17/11	05/28/11
Potassium 40	11.2		1.86		0.252	30	05/17/11	05/28/11
Protactinium 234	-0.0174	U	0.173		0.141	30	05/17/11	05/28/11
Radium (226)	0.839		0.170	0.700	0.030	30	05/17/11	05/28/11
Thallium 208	0.140		0.0644		0.037	30	05/17/11	05/28/11
Thorium 232	0.439		0.264		0.164	30	05/17/11	05/28/11
Thorium 234	0.574	U	1.03		0.862	30	05/17/11	05/28/11
Uranium 235	0.120	U	0.251		0.201	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-011

Radiochemistry

Lab Sample ID: F1E160460-011
 Work Order: MJG42
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1137259	Yld %	
Actinium 228	0.385		0.156		0.127	30	05/17/11	05/28/11
Americium 241	0.0208	U	0.102		0.083	30	05/17/11	05/28/11
Bismuth 212	0.244		0.322		0.235	30	05/17/11	05/28/11
Bismuth 214	0.728		0.153		0.052	30	05/17/11	05/28/11
Cesium 137	0.000896	U	0.0449	0.0700	0.036	30	05/17/11	05/28/11
Cobalt 60	0.0	U	0.0472		0.038	30	05/17/11	05/28/11
Europium 152	-0.0489	U	0.121		0.096	30	05/17/11	05/28/11
Europium 154	-0.0632	U	0.348		0.279	30	05/17/11	05/28/11
Lead 210	0.616	U	0.925	1.50	0.711	30	05/17/11	05/28/11
Lead 212	0.553		0.125		0.055	30	05/17/11	05/28/11
Lead 214	0.600		0.122		0.051	30	05/17/11	05/28/11
Potassium 40	12.9		1.68		0.247	30	05/17/11	05/28/11
Protactinium 234	0.0487	U	0.128		0.103	30	05/17/11	05/28/11
Radium (226)	0.728		0.153	0.700	0.052	30	05/17/11	05/28/11
Thallium 208	0.146		0.0549		0.025	30	05/17/11	05/28/11
Thorium 232	0.385		0.156		0.127	30	05/17/11	05/28/11
Thorium 234	0.486	U	0.966		0.770	30	05/17/11	05/28/11
Uranium 235	0.147	U	0.247		0.195	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-012

Radiochemistry

Lab Sample ID: F1E160460-012
 Work Order: MJG43
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.411		0.194		0.073	30	05/17/11	05/28/11
Americium 241	0.0450	U	0.105		0.083	30	05/17/11	05/28/11
Bismuth 212	0.0784	U	0.338		0.276	30	05/17/11	05/28/11
Bismuth 214	0.546		0.144		0.060	30	05/17/11	05/28/11
Cesium 137	-0.0133	U	0.0532	0.0700	0.042	30	05/17/11	05/28/11
Cobalt 60	0.0	U	0.00992		0.011	30	05/17/11	05/28/11
Europium 152	-0.0149	U	0.112		0.091	30	05/17/11	05/28/11
Europium 154	0.0	U	0.426		0.351	30	05/17/11	05/28/11
Lead 210	0.0710	U	1.33	1.50	1.19	30	05/17/11	05/28/11
Lead 212	0.496		0.120		0.060	30	05/17/11	05/28/11
Lead 214	0.540		0.124		0.053	30	05/17/11	05/28/11
Potassium 40	11.2		1.65		0.286	30	05/17/11	05/28/11
Protactinium 234	-0.0799	U	0.154		0.122	30	05/17/11	05/28/11
Radium (226)	0.546	J	0.144	0.700	0.060	30	05/17/11	05/28/11
Thallium 208	0.250		0.0708		0.030	30	05/17/11	05/28/11
Thorium 232	0.411		0.194		0.073	30	05/17/11	05/28/11
Thorium 234	0.229	U	1.11		0.933	30	05/17/11	05/28/11
Uranium 235	0.0107	U	0.252		0.210	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-013

Radiochemistry

Lab Sample ID: F1E160460-013
 Work Order: MJG44
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g		Batch # 1137259		Yld %	
Actinium 228	0.443		0.156		0.092	30	05/17/11	05/28/11
Americium 241	-0.00460	U	0.103		0.084	30	05/17/11	05/28/11
Bismuth 212	0.172	U	0.266		0.193	30	05/17/11	05/28/11
Bismuth 214	0.719		0.148		0.050	30	05/17/11	05/28/11
Cesium 137	0.000111	U	0.0405	0.0700	0.033	30	05/17/11	05/28/11
Cobalt 60	-0.0129	U	0.0472		0.036	30	05/17/11	05/28/11
Europium 152	0.00473	U	0.0960		0.078	30	05/17/11	05/28/11
Europium 154	0.105	U	0.291		0.224	30	05/17/11	05/28/11
Lead 210	0.0	U	1.11	1.50	0.912	30	05/17/11	05/28/11
Lead 212	0.511		0.114		0.045	30	05/17/11	05/28/11
Lead 214	0.786		0.146		0.048	30	05/17/11	05/28/11
Potassium 40	7.41		1.33		0.451	30	05/17/11	05/28/11
Protactinium 234	0.00747	U	0.135		0.111	30	05/17/11	05/28/11
Radium (226)	0.719		0.148	0.700	0.050	30	05/17/11	05/28/11
Thallium 208	0.0914		0.0446		0.026	30	05/17/11	05/28/11
Thorium 232	0.443		0.156		0.092	30	05/17/11	05/28/11
Thorium 234	0.0	U	1.07		0.881	30	05/17/11	05/28/11
Uranium 235	0.0723	U	0.216		0.174	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-014

Radiochemistry

Lab Sample ID: F1E160460-014
 Work Order: MJG45
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.284		0.184		0.125	30	05/17/11	05/28/11
Americium 241	0.0	U	0.117		0.096	30	05/17/11	05/28/11
Bismuth 212	-0.00926	U	0.327		0.268	30	05/17/11	05/28/11
Bismuth 214	0.641		0.169		0.068	30	05/17/11	05/28/11
Cesium 137	0.00459	U	0.0425	0.0700	0.034	30	05/17/11	05/28/11
Cobalt 60	0.0	U	0.0504		0.041	30	05/17/11	05/28/11
Europium 152	-0.00326	U	0.0988		0.081	30	05/17/11	05/28/11
Europium 154	0.0	U	0.389		0.321	30	05/17/11	05/28/11
Lead 210	-0.282	U	2.14	1.50	1.14	30	05/17/11	05/28/11
Lead 212	0.489		0.123		0.061	30	05/17/11	05/28/11
Lead 214	0.692		0.146		0.058	30	05/17/11	05/28/11
Potassium 40	11.0		1.67		0.451	30	05/17/11	05/28/11
Protactinium 234	0.0200	U	0.126		0.103	30	05/17/11	05/28/11
Radium (226)	0.641	J	0.169	0.700	0.068	30	05/17/11	05/28/11
Thallium 208	0.183		0.0711		0.033	30	05/17/11	05/28/11
Thorium 232	0.284		0.184		0.125	30	05/17/11	05/28/11
Thorium 234	0.375	U	1.11		0.953	30	05/17/11	05/28/11
Uranium 235	0.0516	U	0.273		0.225	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-015

Radiochemistry

Lab Sample ID: F1E160460-015
 Work Order: MJG46
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1137259	Yld %	
Actinium 228	0.698		0.205		0.097	30	05/17/11	05/28/11
Americium 241	0.00115	U	0.105		0.086	30	05/17/11	05/28/11
Bismuth 212	0.184	U	0.346		0.259	30	05/17/11	05/28/11
Bismuth 214	0.415		0.139		0.068	30	05/17/11	05/28/11
Cesium 137	-0.0151	U	0.0506	0.0700	0.039	30	05/17/11	05/28/11
Cobalt 60	-0.00830	U	0.0587		0.047	30	05/17/11	05/28/11
Europium 152	-0.0344	U	0.122		0.096	30	05/17/11	05/28/11
Europium 154	-0.0187	U	0.399		0.327	30	05/17/11	05/28/11
Lead 210	1.17	J	1.21	1.50	0.985	30	05/17/11	05/28/11
Lead 212	0.592		0.135		0.061	30	05/17/11	05/28/11
Lead 214	0.615		0.149		0.065	30	05/17/11	05/28/11
Potassium 40	12.0		1.77		0.313	30	05/17/11	05/28/11
Protactinium 234	0.0625	U	0.145		0.115	30	05/17/11	05/28/11
Radium (226)	0.415	J	0.139	0.700	0.068	30	05/17/11	05/28/11
Thallium 208	0.126		0.0631		0.040	30	05/17/11	05/28/11
Thorium 232	0.698		0.205		0.097	30	05/17/11	05/28/11
Thorium 234	-0.0509	U	1.18		0.866	30	05/17/11	05/28/11
Uranium 235	0.184	U	0.250		0.193	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 Kev line of Bi-214.

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-016

Radiochemistry

Lab Sample ID: F1E160460-016
 Work Order: MJG47
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.455		0.287		0.170	30	05/17/11	05/28/11
Americium 241	-0.0452	U	0.420		0.098	30	05/17/11	05/28/11
Bismuth 212	0.655		0.341		0.102	30	05/17/11	05/28/11
Bismuth 214	0.579		0.184		0.070	30	05/17/11	05/28/11
Cesium 137	-0.0142	U	0.203	0.0700	0.062	30	05/17/11	05/28/11
Cobalt 60	-0.0420	U	0.185		0.080	30	05/17/11	05/28/11
Europium 152	0.0	U	0.158		0.131	30	05/17/11	05/28/11
Europium 154	0.235	U	0.434		0.310	30	05/17/11	05/28/11
Lead 210	0.738	U	1.14	1.50	0.952	30	05/17/11	05/28/11
Lead 212	0.570		0.127		0.045	30	05/17/11	05/28/11
Lead 214	0.588		0.146		0.049	30	05/17/11	05/28/11
Potassium 40	10.8		2.06		0.305	30	05/17/11	05/28/11
Protactinium 234	-0.00449	U	0.123		0.101	30	05/17/11	05/28/11
Radium (226)	0.579	J	0.184	0.700	0.070	30	05/17/11	05/28/11
Thallium 208	0.122		0.0745		0.046	30	05/17/11	05/28/11
Thorium 232	0.455		0.287		0.170	30	05/17/11	05/28/11
Thorium 234	0.772	U	1.18		0.965	30	05/17/11	05/28/11
Uranium 235	-0.112	U	0.585		0.212	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

J Result is greater than sample detection limit but less than stated reporting limit.
 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214.
 F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-017

Radiochemistry

Lab Sample ID: F1E160460-017
 Work Order: MJG48
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD			pCi/g			Batch # 1137259	Yld %	
Actinium 228	0.196		0.145		0.095	30	05/17/11	05/28/11
Americium 241	-0.00811	U	0.0914		0.074	30	05/17/11	05/28/11
Bismuth 212	0.186	U	0.297		0.218	30	05/17/11	05/28/11
Bismuth 214	0.758		0.140		0.033	30	05/17/11	05/28/11
Cesium 137	0.0	U	0.0345	0.0700	0.028	30	05/17/11	05/28/11
Cobalt 60	-0.00900	U	0.0497		0.039	30	05/17/11	05/28/11
Europium 152	-0.00326	U	0.103		0.084	30	05/17/11	05/28/11
Europium 154	-0.0378	U	0.345		0.279	30	05/17/11	05/28/11
Lead 210	0.604	U	1.04	1.50	0.811	30	05/17/11	05/28/11
Lead 212	0.444		0.108		0.047	30	05/17/11	05/28/11
Lead 214	0.832		0.128		0.034	30	05/17/11	05/28/11
Potassium 40	4.70		1.12		0.476	30	05/17/11	05/28/11
Protactinium 234	0.0521	U	0.144		0.115	30	05/17/11	05/28/11
Radium (226)	0.758		0.140	0.700	0.033	30	05/17/11	05/28/11
Thallium 208	0.0720		0.0463		0.030	30	05/17/11	05/28/11
Thorium 232	0.196		0.145		0.095	30	05/17/11	05/28/11
Thorium 234	0.561	U	0.954		0.753	30	05/17/11	05/28/11
Uranium 235	0.00826	U	0.211		0.173	30	05/17/11	05/28/11

NOTE(S)

Data are incomplete without the case narrative.
 Bold results are greater than the MDL.

U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214

F1E160460

Tetra Tech EC, Inc.

Client Sample ID: 06NPRBRAO-018

Radiochemistry

Lab Sample ID: F1E160460-018
 Work Order: MJG49
 Matrix: SOLID

Date Collected: 04/26/06 1200
 Date Received: 05/16/11 1310

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	RL	MDL	Count Time	Prep Date	Analysis Date
Gamma Ra-226 & hits by EPA 901.1 MOD				pCi/g		Batch # 1137259	Yld %	
Actinium 228	0.588		0.157		0.055	30	05/17/11	05/28/11
Americium 241	-0.0212	U	0.0866		0.069	30	05/17/11	05/28/11
Bismuth 212	0.287		0.300		0.205	30	05/17/11	05/28/11
Bismuth 214	0.272		0.112		0.071	30	05/17/11	05/28/11
Cesium 137	0.0155	U	0.0442	0.0700	0.034	30	05/17/11	05/28/11
Cobalt 60	-0.00567	U	0.0505		0.040	30	05/17/11	05/28/11
Europium 152	0.00505	U	0.0615		0.049	30	05/17/11	05/28/11
Europium 154	-0.0292	U	0.326		0.264	30	05/17/11	05/28/11
Lead 210	-0.495	U	2.24	1.50	0.987	30	05/17/11	05/28/11
Lead 212	0.533		0.113		0.053	30	05/17/11	05/28/11
Lead 214	0.527		0.117		0.057	30	05/17/11	05/28/11
Potassium 40	10.3		1.52		0.316	30	05/17/11	05/28/11
Protactinium 234	-0.0000491	U	0.106		0.087	30	05/17/11	05/28/11
Radium (226)	0.272	J	0.112	0.700	0.071	30	05/17/11	05/28/11
Thallium 208	0.207		0.0524		0.018	30	05/17/11	05/28/11
Thorium 232	0.588		0.157		0.055	30	05/17/11	05/28/11
Thorium 234	0.589	U	0.887		0.732	30	05/17/11	05/28/11
Uranium 235	0.0248	U	0.187		0.154	30	05/17/11	05/28/11

NOTE(S)

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 U Result is less than the sample detection limit.

The MDL is an estimate of the measured concentration at which there is a 99% confidence that a given analyte is given sample matrix. This is functionally analogous to the "critical value" or the "limit of detection".

Ra-226 results analyzed by EPA 901.1 MOD were calculated and reported from the 46.09 percent abundant 609.31 KeV line of Bi-214
 F1E160460